PUBLIC WORKS

Sept. 1959

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H. H. Hester, Street Superintendent of Fort Worth, Texas has the supervision of more than 1,500 miles of streets as his responsibility. Long active in the APWA he is now a Regional Director. More on page 22.

GALION® 12-Ton Pneumatic-Tire Roller

NEW NEW NEW NEW NEW

2239

Only Galion offers EQUA-MATIC front end construction

Through the automatic balancing action of three king pins, safe roller support is always assured when working over uneven or sloping ground. Galion's exclusive EQUA-MATIC design provides an equalizing movement straight up and down of all five steering wheels, and an oscillating up and down movement of the end wheel pairs. Thus, firm compacting contact is maintained with the surface at all times by the five wheels.

plus 18 other important features

- ROLL-O-MATIC or standard gear shift drive.
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- LARGEST ballastable capacity in relation to overall size—in excess of 24,000 lbs. total weight with wet sand ballast.
- EIGHTY horsepower gasoline engine.
- HEAVIEST construction—8,400 lbs. metal weight.
- LOW center of gravity.
- 100% COVERAGE—treads of the nine tires overlap.
- WIDE RANGE of speeds—same range forward and reverse.
- SHORT drive shaft.
- DOUBLE drive chains to each pair of drive wheels.
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- EXCELLENT visibility for operator.
- SHORT turning radius.
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- SWIVEL seat, fully adjustable.

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GREATER STABILITY

Maximum stability and support across the entire front end of the roller is achieved by GALION'S three-point king pin suspension of the five steering wheels. PATENT PENDING.

SYNCHRONIZED 5-WHEEL STEERING

Each of the five steering wheels is adjusted to always steer in its own true arc. This design eliminates the pushing and gouging of material which results when no provision is made to compensate for arcing variations in multiple-wheel steering.

EASY SERVICING

Unitized assembly permits each wheel and wheel brake to be serviced individually, as well as the oil-tight double drive chains. The entire power train can be removed as a unit.

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better than ever FLUSH KLEEN® clog-proof sewage pumping

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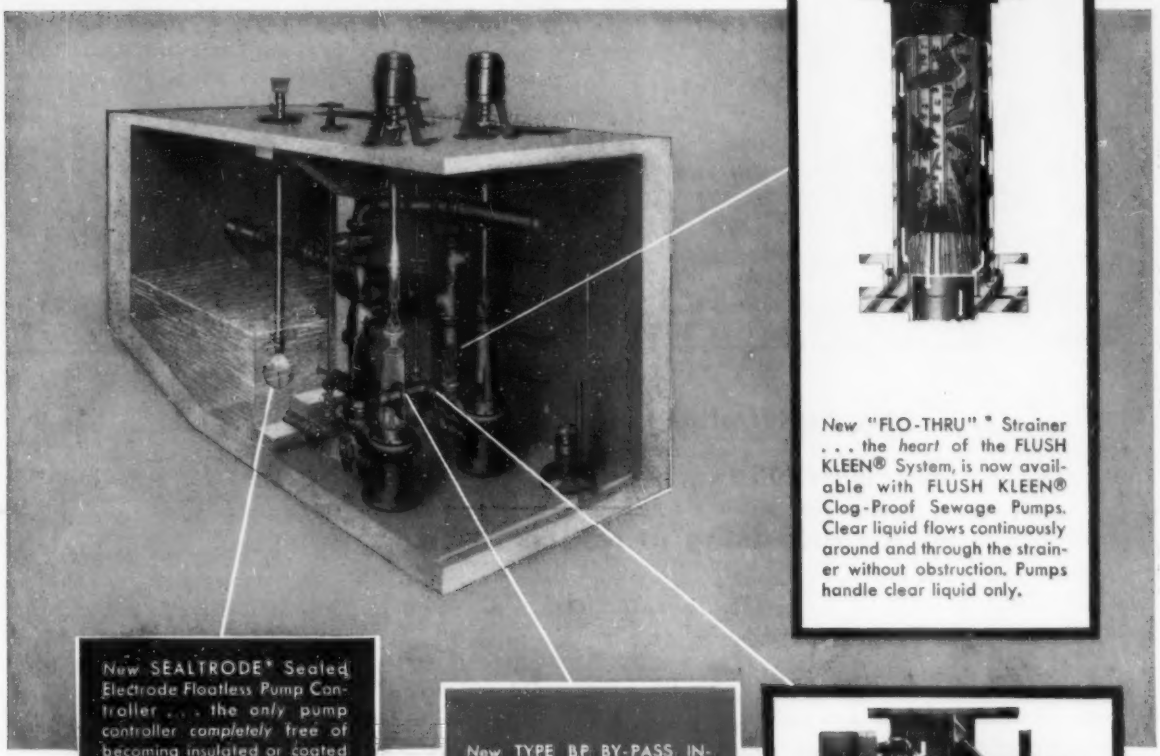
- By-pass fittings allow greater inflow capacity
- Pumps handle clear liquid only
- Absolutely reliable pumping performance
- Less maintenance
- 100% standby capacity
- Longer pump life

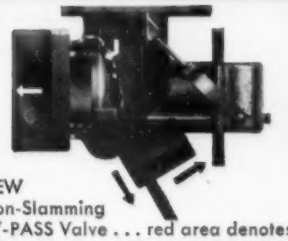


High Wet Strength Paper Products And Other Solids are never a problem with the *new* "FLO-THRU"* Strainer.

New "FLO-THRU" * Strainer . . . the *heart* of the FLUSH KLEEN® System, is now available with FLUSH KLEEN® Clog-Proof Sewage Pumps. Clear liquid flows continuously around and through the strainer without obstruction. Pumps handle clear liquid only.

New SEALTRODE* Sealed Electrode Floatless Pump Controller . . . the *only* pump controller *completely* free of becoming insulated or coated with grease or corrosive elements found in sewage and drainage water.

New TYPE BP BY-PASS INFLOW FITTINGS . . . permitting strained sewage to flow directly to the Wet Well, completely by-passing the pumps.



NEW Non-Slamming BY-PASS Valve . . . red area denotes valve open . . . allowing by-passing to occur.

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FOOD MACHINERY AND CHEMICAL CORPORATION
Chicago Pump Company
622F DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

1959 50 YEARS CHICAGO PUMP COMPANY 1909

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THIS D4 IS DOING MORE THAN BURYING REFUSE

1 **It's reclaiming land with high potential value**

2 **It's providing a source of fill dirt**

3 **It's disposing of refuse**

Melbourne, Florida, is the largest city in the Cape Canaveral Guided Missile Area and growing fast. But its welcome growth has also brought problems—including finding land for needed parks, providing fill dirt for road construction and refuse disposal.

The economical—in fact, highly profitable—answer to all three problems has been a well-planned sanitary landfill operation, using a dependable Cat D4 Tractor.

The city is currently dumping some 1,700 cu. yd. of refuse in a swampy area every week. The D4 spreads, compacts and covers it with a foot of earth daily. When completed, it will provide a park. Then, the landfill operation will be moved to another area where much-needed fill dirt for road construction is now being removed. Buried refuse will take the place of the dirt, reclaiming the land for profitable use.

City Manager Tejis Huguely tells why the city picked a D4 for this work: "We were using the county's D4 and were pleased with its performance. When it came time to buy our own tractor we decided the D4 was the right one."

Your Caterpillar Dealer has a complete line of earthmoving equipment for construction, maintenance and landfill operations. He will be happy to demonstrate the most suitable Caterpillar-built equipment for your city's needs. No obligation, of course. Get in touch with him today!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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THE D4...
FOR ECONOMICAL
LAND RECLAMATION

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

SEPTEMBER, 1959 • Volume 90, Number 9

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BPA

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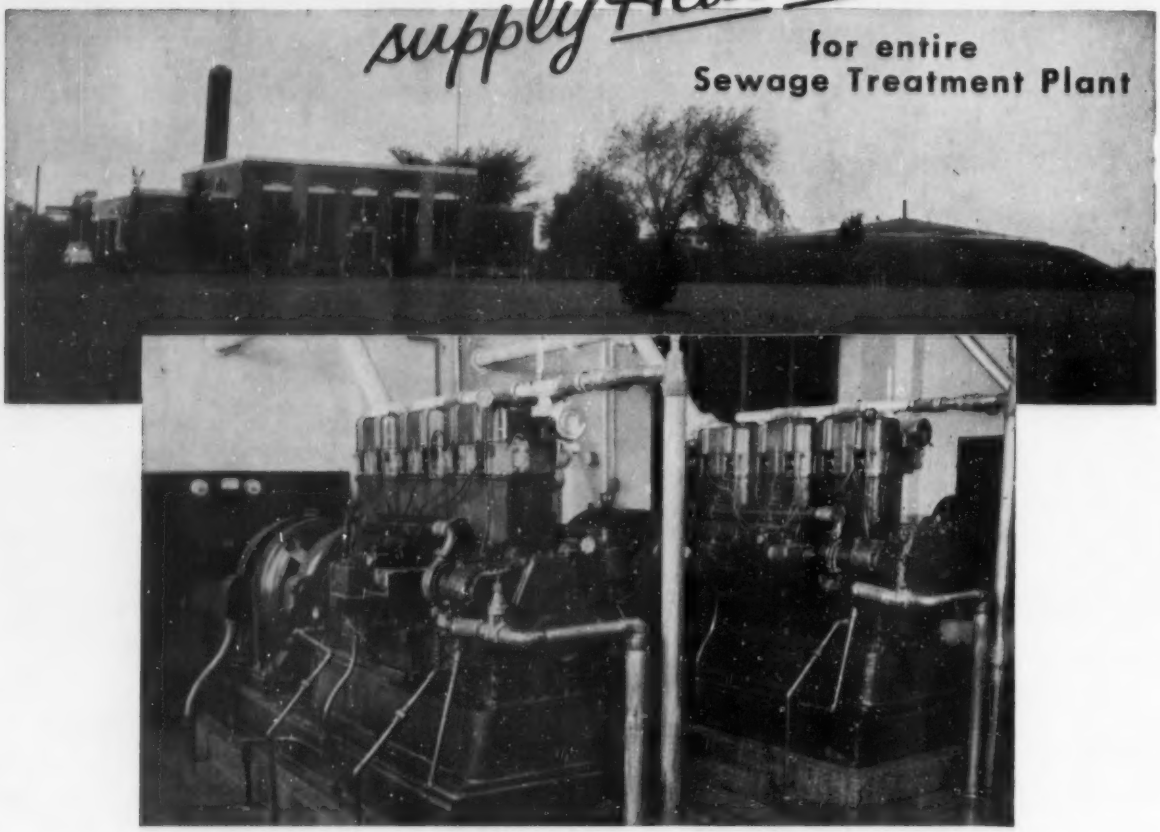
TWO ROILINE ENGINES supply Heat and Power for entire Sewage Treatment Plant

(Formerly LE ROI)



City of Oshkosh, Wis., sewage treatment plant powered by two Model F-1500 Roiline Engines—1503 cu. in. displ., 6¾-in. bore x 7-in. stroke, counterbalanced crankshaft—each 215 max. hp at 1200 rpm.

Operating continuously, but alternately . . . one engine working, the other standing by . . . two F-1500 ROILINES, driving 50 KW generators, supply heat and power for this entire sewage treatment plant, including the digestors. It is not unusual for ROILINES in service like this to run 30,000 hours or more without major overhaul.

Not only dependable power but low up-keep and long service life is built into ROILINE Engines. With a close-to-perfection combustion chamber that gives you more horsepower per fuel dollar. With full length guided valve stem mechanisms, light weight cam ground aluminum pistons, precision bearings, full flow oil filters, sectional water-cooled exhaust manifolds, large main bearings, full pressure lubrication, and other big features.

For details, send for Bulletin E-9.

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THE EDITOR'S POINT OF VIEW

Essentials for Progress in the Water Works Field

THE AMERICAN Water Works Association, with its advancement program, has recognized the need to upgrade positions and salaries of water works employees. This need is further emphasized by the small proportion of engineers who are electing sanitary engineering, which is in direct contrast with tremendously increasing demands for water.

If our profession is to be in a position to meet such increasing water demands, salaries must be commensurate with the position to attract capable personnel into the field. Justification for the advancement program is certainly unquestioned, but its success must depend upon active participation by everyone, right down the line. The ultimate goal is an understanding and appreciation, by the public, of the high investment and expense necessary to deliver a quality water in ample quantity for 24 hours a day and 365 days of the year.

Certain pre-requisites are extremely desirable in any individual who participates in the water works advancement program. First he should be a member of the American Water Works Association. Secondly he should always keep in mind that he is selling a product to a consuming public, which is becoming increasingly critical of quality. The consumer of today is much less likely to be understanding if his water contains color, turbidity, taste or odor, and an understanding public is desirable where a rate increase is necessary to provide more adequate salaries in the water supply field.

Practically all individuals in this field recognize that, in a sense, they are custodians of the health of every one of their consumers. Such an excellent job has been done in the disinfection of water, that instances of water-borne diseases throughout the United States are almost non-existent. Color and turbidity problems have been solved by installation of suitable treatment plants. However, some existing gravity supplies should give serious consideration to installation of facilities for delivering a clear colorless water. Hard water, red water due to iron and black water due to manganese are problems which are all capable of being solved by proper treatment.

Some water treatment plants have tremendously improved public relations by instituting control measures and treatment to eliminate tastes and odors from their supply. However, the situation in the overall United States is summarized in the words of Abel Wolman—"The road to universally palatable water has been only partially traversed, even though suitable control methods are available. Some operators refuse to admit their responsibility to their consumers, while others laugh off complaints, and still others do not know that the water they are delivering is unpalatable." Thus it is evident that much remains to be done in the control of water quality as a pre-requisite in advancement of the water works profession.

Turning Sanitary Landfills into Compost

SOME CITIES MAY be running out of landfill space; nearly every city is interested in composting because this promises some return on a necessary municipal service involving a considerable outlay. Depending on conditions which have not been well established a properly constructed landfill becomes inert in a moderately short time. This inert material could readily be processed for compost; in addition to the possible profit from the sales of compost, a fill area would be reclaimed for future use. Perhaps the decomposition and stabilization processes in the landfill could be accelerated or improved by the addition, during landfill construction, of some of the special agents now available for compost use.

Anyway the processing of stabilized landfills is worth looking into, especially in those cases where space is an important factor.

A Do-It-Yourself Job: Getting Ready for Winter

NOW IS THE time to get ready for winter. Open roads and usable streets are recognized as a necessity; the problem is to utilize the best means now available to insure safe all-winter travel. Our August issue carried a number of articles on what representative governmental units are doing to prepare for winter. But solving these winter problems is perhaps the original do-it-yourself job for every city, county and state; no one else can help very much. And a job as big as this is in so much of our country needs lots of planning and preparation. Now is the time—or maybe past time—to start.

NEW!
EPON® 1001
INSIDE COATING

The most important potable water news in years!

. . . For all piping—metal, concrete, tile
. . . For any water condition
. . . For any practical flow rate *and now*—
. . . Meets existing public health requirements

Among the toughest, most durable resins known to modern chemistry, Shell Epon 1001 is an ideal interior pipeline coating for potable water lines. It has an outstanding record of performance as a chemical-resisting coating for oil pipelines, tank interiors, and as a finish coating for appliances, trucks, and plant equipment exposed to corrosive fumes.

Conventionally cured coatings of Epon 1001 have truly remarkable adhesion, especially to metals, excellent resistance to impact, cavitation, and abrasion. Outstandingly resistant to water erosion, Epon 1001 interior pipe coatings have given years of service, even in difficult water areas, with no perceptible deterioration or contamination of supply.

Epon 1001 may be applied by brush, spray or pig. Setting takes place at room temperature within an hour or so. Curing time may be considerably shortened by the application of heat.

The best news of all is that Epon 1001 pipeline coating can reduce your maintenance costs, no matter what your potable water condition . . . and often enables you to supply higher purity water.

* * *

Contact your nearest Shell Chemical district office for complete information on this important new development. Your Shell Chemical district representative has all the facts you need to help you get started right away.

EPON puts the power in paint

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SHELL

CAST IRON PIPE WINS THE VOTE

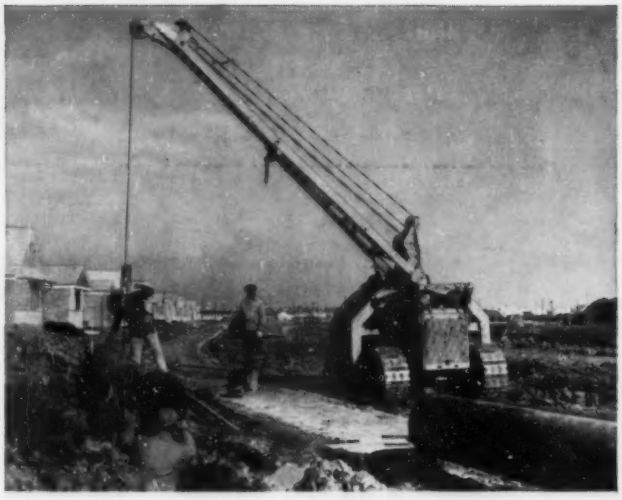
Recently a questionnaire was mailed to water utility managers all over the U. S. One question asked was: *What kind of pipe do you prefer and why?* With 42 states heard from, the vote is overwhelmingly in favor of cast iron! Here are typical comments:

"1. Cast iron pipe is permanent—long life. 2. Lined pipe cuts down complaints of 'red' or 'rusty' water. 3. Mechanical joints are time and labor-saving over other types of joints, and are more flexible."

—Iowa

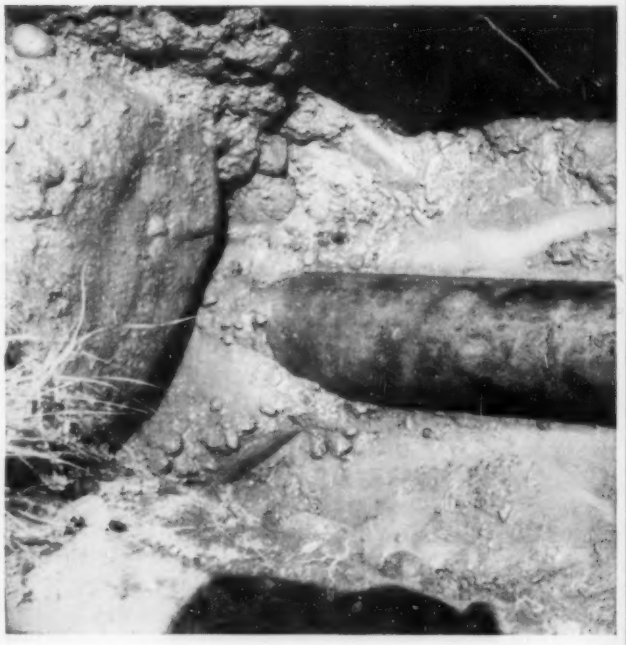
"Long life has been proven. I have personally observed pieces cut out of existing systems which were laid prior to the turn of the century. Such observations indicated the pipe to be as good as the day it was laid."

—Kansas



"Cast iron pipe has been in use for 200 years, and the record speaks for itself. All the other types have their use, but we would not recommend them in a well-built, expanding water works distribution system or large transmission lines."

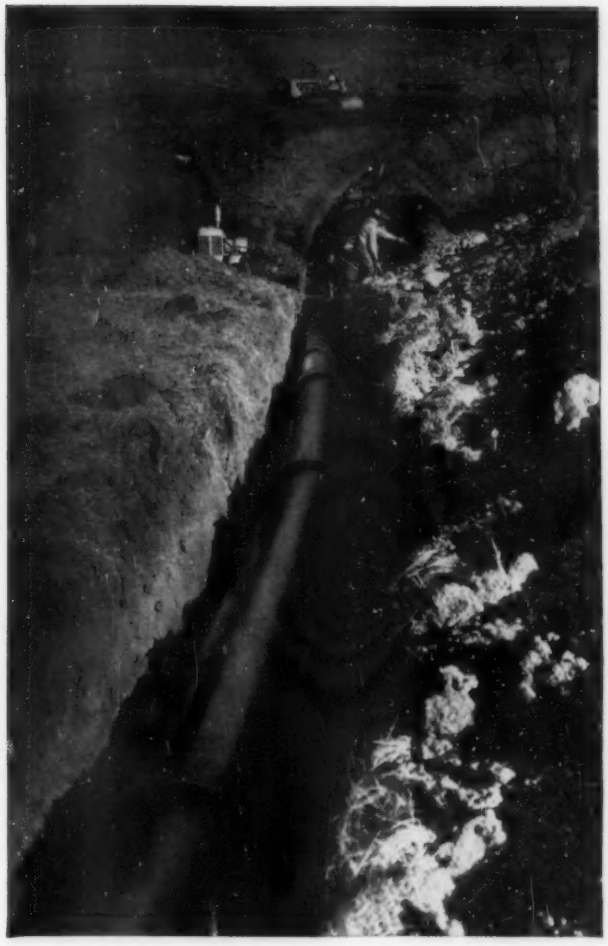
—Illinois



HANDS DOWN!

"We are located in a limestone area. We find cast iron pipe will absorb more rock damage than any other pipe. We also use cement lined pipe to overcome our corrosion condition which exists in our water."

—Pennsylvania



"It is very easy and fast to lay, and you can swing the joint enough in places where you can save time and money."

—New Jersey

Three reasons why cast iron pipe is America's greatest water carrier:

1. More miles of underground cast iron water mains are now in use than of all other kinds of pipe combined.
2. More miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.
3. Impartial surveys prove that today's water utility officials and consulting engineers prefer cast iron pipe for underground water distribution by an overwhelming majority.

. . . good reasons for you to choose

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Write for complete information to Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

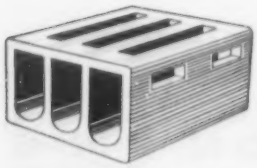
GOOD FISHING follows

Underwood & Underwood photo

Members of the TFFI are proud of the important part their products have played in curbing and curing stream pollution through their contribution of vitrified clay underdrain blocks in Trickling Filters. These filters have had such wide acceptance among engineers that over 2,700 sewage works are now employing them, serving over 35% of our population.

TFFI

TRICKLING FILTER



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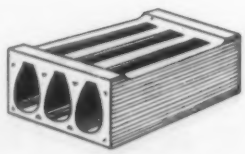

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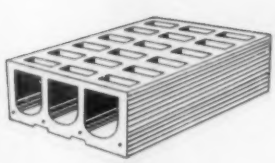

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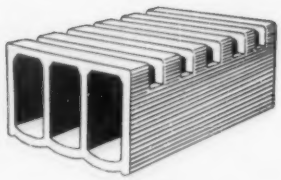
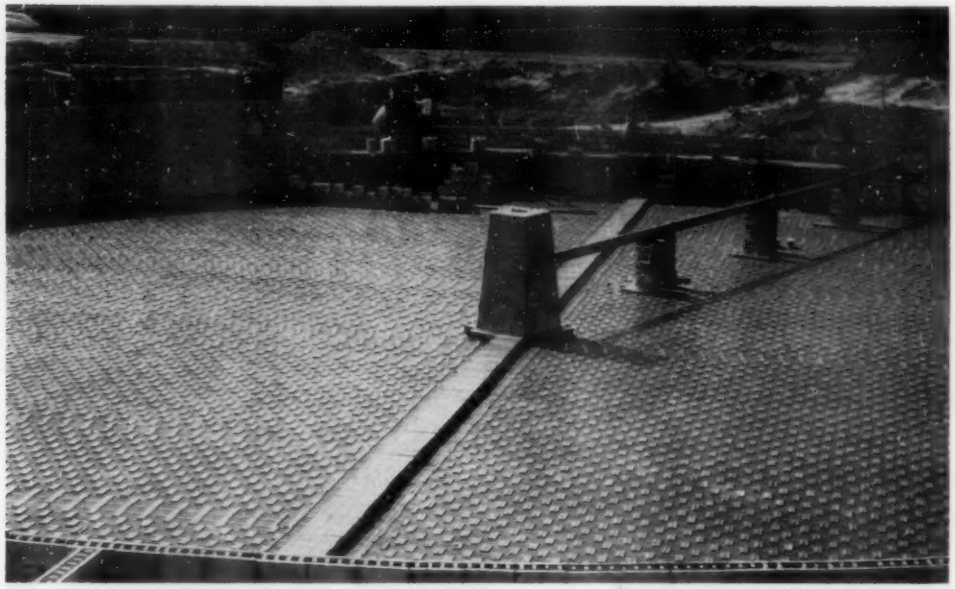


TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas

GOOD FILTERS . . .

Trickling Filters with TFFI Vitrified Clay Block Underdrains are good filters!



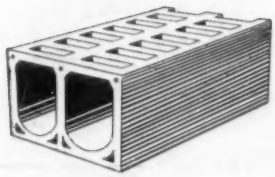
Ozark, Alabama, standard rate filters with TFFI specification underdrain blocks. Capacity 1 MGD flow.

ENGINEERS are invited to ask any member of the Institute for a copy of approved Specifications ASTM C-159-55 for use in designing Trickling Filters.

Trickling Filters afford such major advantages as low initial, operating and maintenance costs; efficiency even under overloads, and a minimum of operating personnel.

Vitrified Clay floor blocks of TFFI Specifications for the underdrains are a big factor in the success of Trickling Filters. These blocks combine many points of permanent excellence. They defy the destructive forces of acids, alkalis and bacterial action; are guaranteed for 50 years; are made in modern plants under rigid quality controls impossible for most substitute materials; have maximum crushing strength, give higher velocity in flow, and offer light weight for ease of handling and laying.

FLOOR INSTITUTE



ARMCRE
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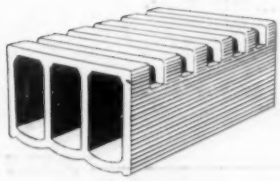

TRANSLOT
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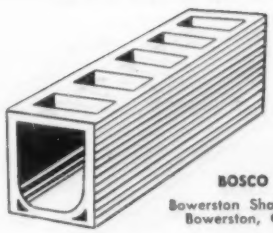


BOSCO
Bowerston Shale Co.
Bowerston, Ohio

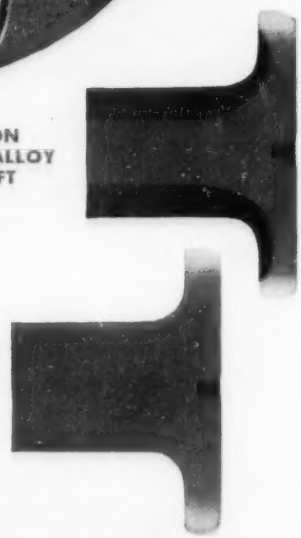
In New Trucks or Old—
EATON INDUCTALLOY
AXLE SHAFTS

LAST 3 to 10 TIMES LONGER

Through billions of miles of heavy-duty service, Eaton Inductalloy Axle Shafts have proved their ability to deliver superior performance. Freedom from break-down—more time on the road, less time in the shop—plus thousands of trouble-free miles added to axle life, mean lower over-all operating cost.

Eaton's exclusive method of dual hardening truck axle shafts produces an extremely hard case extending deep into the material structure, and enables Inductalloy Axle Shafts to handle more work and abuse without fatigue failure.

Eaton Inductalloy Axle Shafts are available not only in new axle equipment, but also as replacements for earlier models. Ask your truck dealer for complete information.



EATON INDUCTALLOY SHAFT

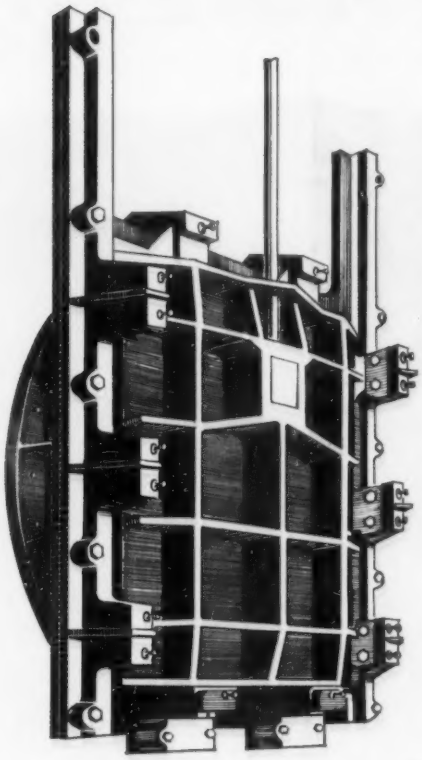
ORDINARY AXLE SHAFT

EATON

AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO

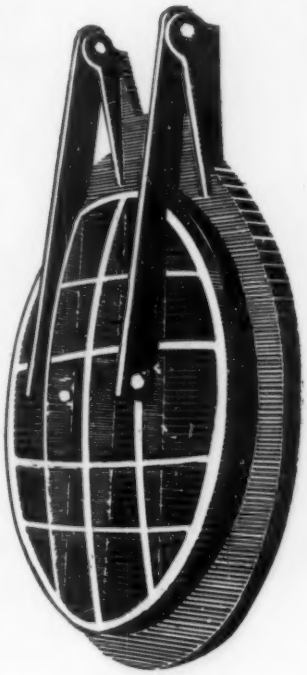
New steels are born at Armco

There's an Armco Gate to meet *Your* Needs



World's most complete range of *SLUICE GATES*

. . . and *FLAP GATES*



PLUS

a complete line of roller and radial gates, light duty slide and turn-out gates, and meter gates. Send for the Armco Gate Catalog. If you have a specific job in mind, check box in the coupon and our representative will call. Armco Drainage & Metal Products, Inc., 7679 Curtis Street, Middletown, Ohio.

ARMCO DRAINAGE & METAL PRODUCTS, INC.
7679 Curtis Street, Middletown, Ohio

☐ Send descriptive literature.

☐ Please have representative call.

Name_____ Title_____

Company_____

Street_____

City_____ Zone_____ State_____

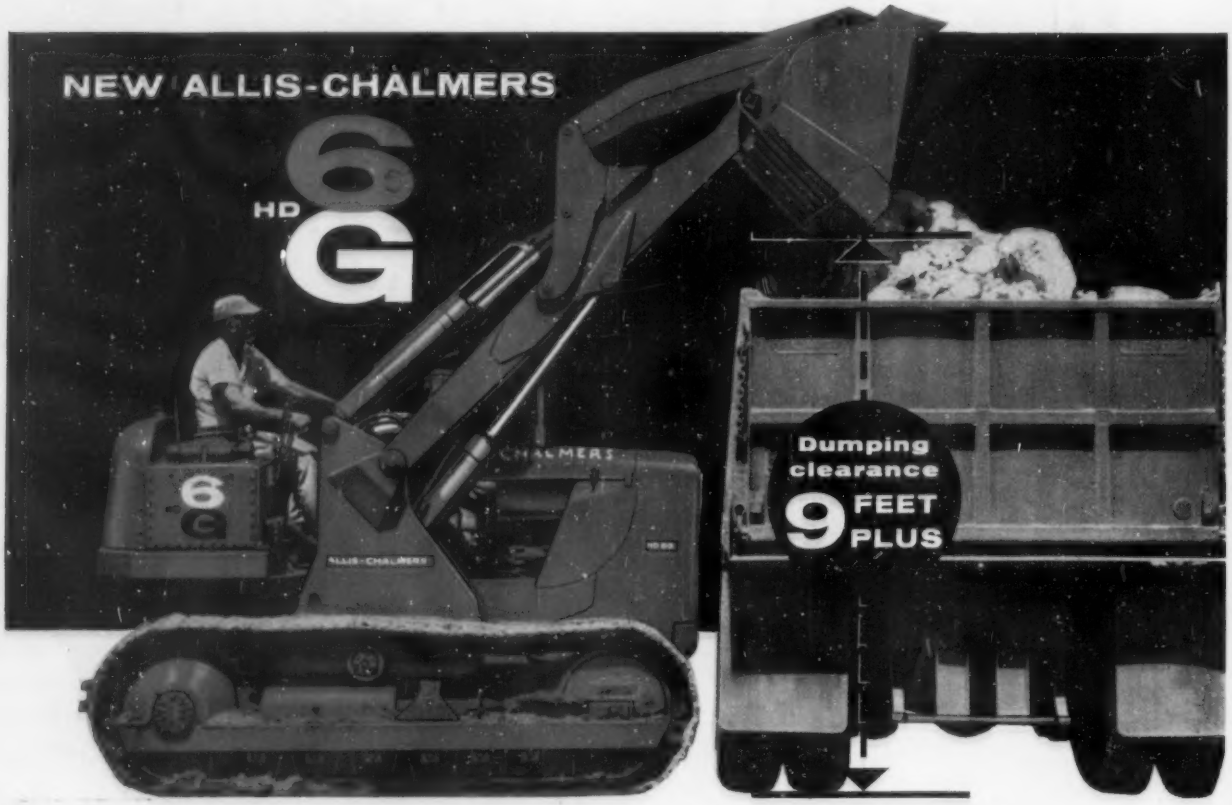
ARMCO DRAINAGE & METAL PRODUCTS

Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

new slant in tractor shovels . . .
everything you need for

BIG PRODUCTION AT



What you want most in a 1½-yd tractor shovel is here. The new 6G gives you advanced-design features that mean extra productive ability you can *measure*—plus new comfort and convenience for the operator, servicing simplicity and big-tractor strength.

But this is only half the story. Your Allis-Chalmers dealer can tell you much, much more—and *prove* it, too! Why not let him set up a demonstration *now*, on your tractor shovel job? Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Height with a bonus in reach

With as much as a foot more dumping height than the maximum for ordinary tractor shovels, the 6G reaches 'way out to dump over the center of big, sideboarded, 12-yd trucks. This height-and-reach combination pays off on other jobs, too—like stockpiling or loading out over the sides of excavations.

move ahead with **ALLIS-CHALMERS** AC . . .

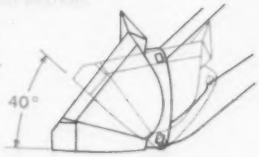
LOW COST

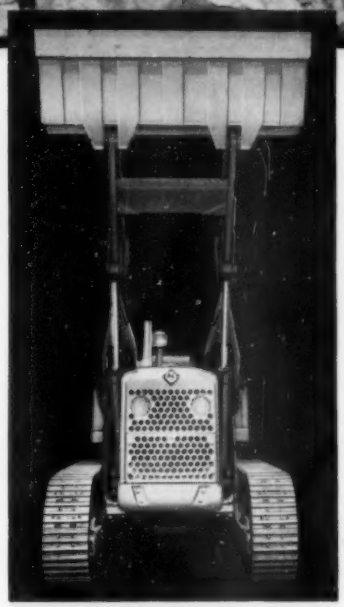
- 72 net engine hp
- 21,000 lb
- 1½-yd general purpose bucket
- 40° bucket tip-back
- Fast reverse to 4.1 mph
- Rugged "in-line" booms and linkage
- Best dump height, reach in its class

Super pry-out action

The new 6G's curved-bottom bucket puts a 10¾-ton force at the cutting edge. This unique "rolling-leverage" action is far more effective than the fixed, toe-and-heel principle of an ordinary, shoe-type bucket bottom. You can break out stubborn boulders, stumps and old pavement easily—get *full* loads *fast* in hardest materials.

Bucket tips back 40° on curved, box-section bottom.





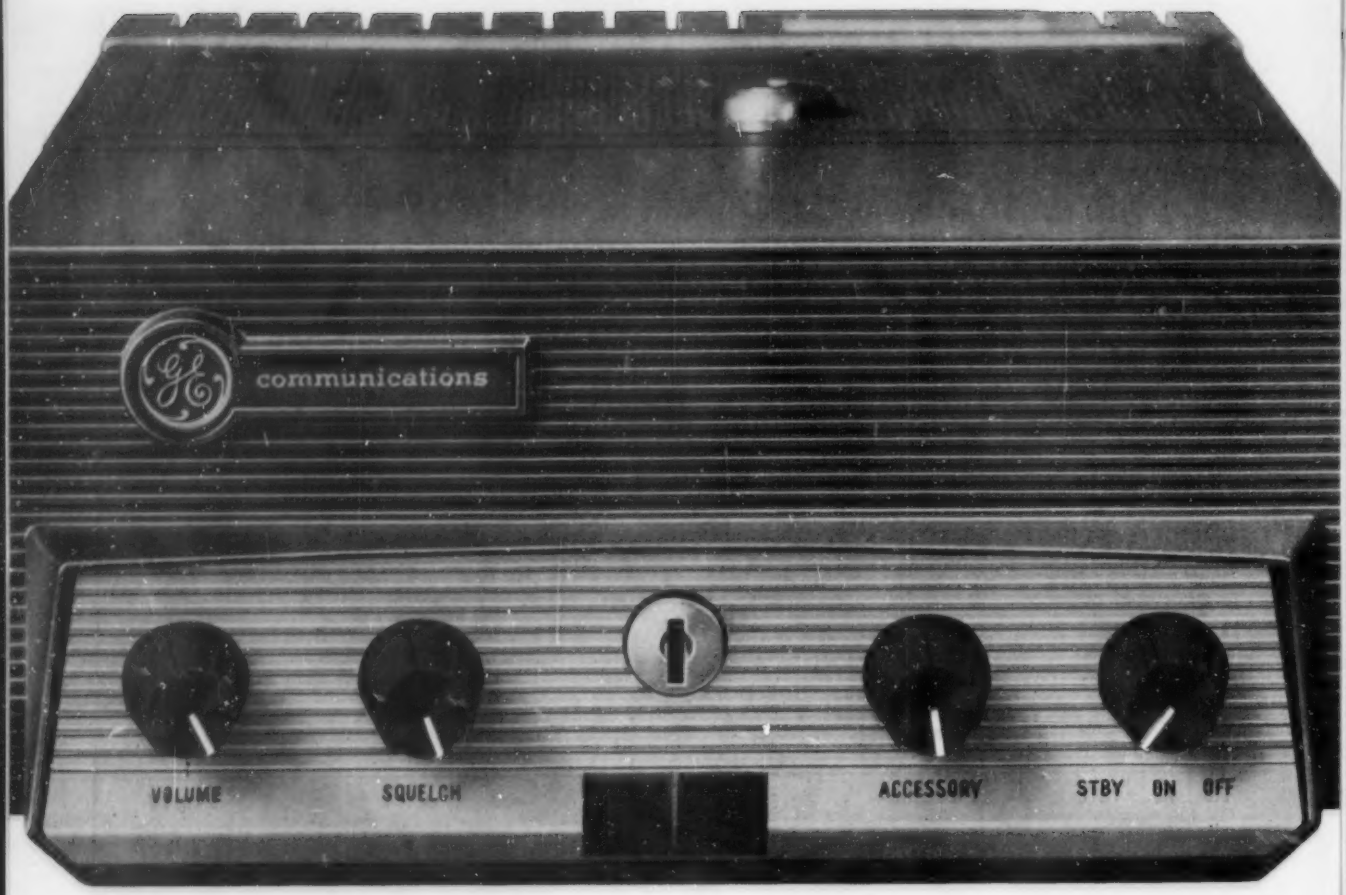
Speed with stability and control

Shift from any forward speed to either reverse speed with a single lever—choose the *right* speed for every tractor shovel function. Powerful hydraulics put big loads right to the top, then bring the bucket down in a smooth, swift cycle. Nearly seven feet of track on the ground . . . positive, accurate controls . . . and new "down-slope" visibility let you handle the bucket and tractor with unheard-of balance and precision.

"In-line" strength

Booms and linkage are twin towers of solid-steel strength, straddle-mounted on wide-spaced pivots in the double-walled side frames. Lift and dump cylinders operate in exactly the same line, put dependable hydraulic power to work *straight from the shoulder.*

. . . power for a growing world



Today's smallest two-way mobile radio - actual size!

New General Electric Transistorized Progress Line

General Electric's new Transistorized Progress Line will fit in more places, in more different positions, than any other two-way mobile radio you can buy today.

Not only is this the world's smallest, lightest commercial two-way mobile radio, but standby battery drain is so low you need never turn off your TPL mobile unit, just like the clock in your car. You install no special generator, use less gas, require fewer engine jobs.

TPL is the first two-way radio that transmits up to 75 watts of power in high band . . . the first that really fits under the dash . . . the first to realize the full benefits of transistorized design (no more than four tubes) . . . the first to eliminate bulky cables through new one-piece design of receiver control and transmitter . . . the first with shielded dirt-free ventilation.

The new General Electric TPL ushers in a new era of convenience and reliability in mobile communications. Don't miss all the exciting details. Write General Electric Company, Communication Products Department, Section 3799, Mountain View Road, Lynchburg, Virginia.

GENERAL ELECTRIC

Communication Products Department

TEAR OUT FOR HANDY REFERENCE

all new...
all diesels...
all from
FORD...

TEAR OUT FOR HANDY REFERENCE

For rock bottom original cost

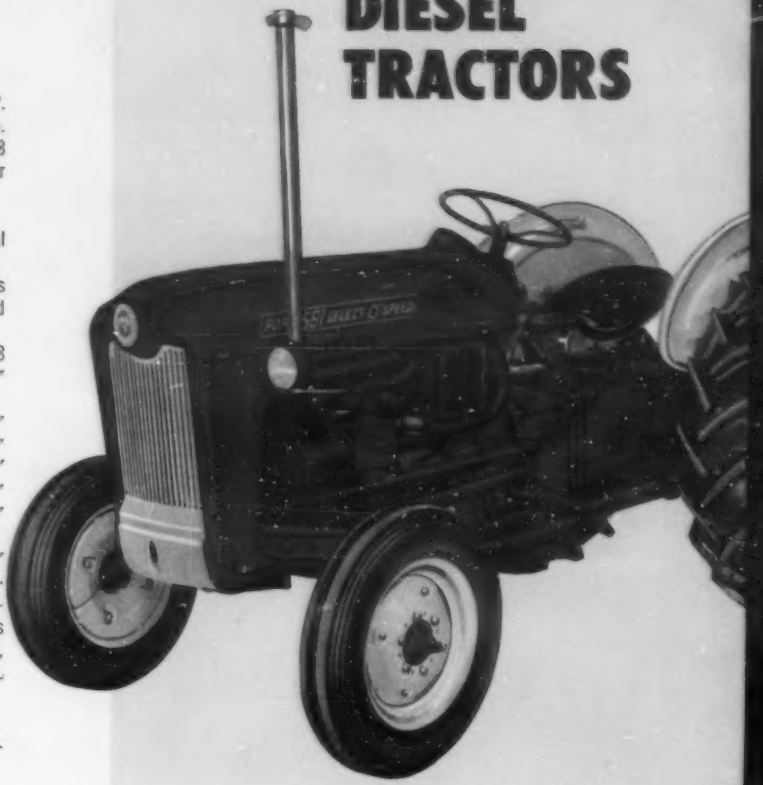
***Lowest* cost diesel tractors in their power class!**

Max. corrected brake H.P. (less accessories @ 2200 rpm; manufacturer's rating) ..... 41 H.P.
Engine displacement ..... 144 cu. in.
Number of models 8
Transmission options ..... 4 or 10-speed "Select-O-Speed"
Heavy duty front end with industrial clutch ..... Optional
Available without hydraulic system and power take-off ..... Yes
Front tires ..... 5.50 x 16 (6-ply 6.50 x 16 and 7.50 x 16 for HD front end)
Rear tires ..... 10 x 28 and 11 x 28
Wheelbase at 52" front tread ..... 74.50"
Turning radius, brake locked (w/52" min. tread) ..... 8'11"
Overall height w/11" rear tires ..... 56.15"
Overall length at 52" front tread ..... 120.83"
Overall width at 52" tread ..... 63.88"
Overall width at 76" tread ..... 87.50"
Min. ground clearance (under transmission case) ..... 13.22"
Factory installed options include: Power steering, power adjusted wheels, auxiliary over-under transmission which provides 12 speeds forward when used with 4-speed transmission, and new "shift-on-the-go" Select-O-Speed.
Typical working weight with front and rear tire fill, front and rear wheel weights ..... 4716 lbs.

FORD

601 SERIES

DIESEL TRACTORS



For economy, dependability on the big jobs

Gallon-an-hour fuel scrimper. Operates for pennies an hour, dimes a day!

Max. corrected brake H.P. (less accessories @ 1700 rpm;

FORDSON

POWER MAJOR DIESELS

Max. corrected brake H.P. (less accessories @ 1700 rpm; manufacturer's rating) ..... 54 H.P.
Engine displacement ..... 220 cu. in.
Number of models 4
Transmission ..... 6 speeds forward, 2 reverse
Available without hydraulic system ..... Yes
Front tires ..... 7.50 x 16
Rear tires ..... 12 x 38 and 14 x 30
Wheelbase ..... 80″
Turning radius, brake locked (w/58″ min. tread) ..... 12′1″
Height to top of steering wheel ..... 63″
Overall length ..... 130.5″
Overall width, maximum ..... 85″
minimum ..... 65″
Min. ground clearance (drawbar) ..... 12.75″
Factory installed options include: Power steering, raised or "live" power take-off, automatic clutch release, belt pulley and horizontal muffler.
Typical working weight with front and rear tire fill, front and rear wheel weights ..... 7361 lbs.

And for peak productivity on industrial jobs

Direct injection fuel system with automatic timing for peak power, peak savings on fuel!

Max. corrected brake H.P. (less accessories @ 2200 rpm; manufacturer's rating) ..... 56 H.P.
Engine displacement ..... 172 cu. in.
Number of models 5
Transmission options ..... 4-speed, reversing, "Select-O-Speed"
Available without hydraulic system and power take-off ..... Yes
Front tires ..... 7.50 x 16—8 ply
Rear tires ..... 12 x 28, 13 x 24, 13 x 28 and 14 x 24
Wheelbase ..... 81.5″
Turning radius, brake locked (w/54″ min. tread) ..... 9′6″
Overall height (14 x 24 rear tires) ..... 57.72″
Overall length (14 x 24 rear tires) ..... 128″
Overall width (14 x 24 rear tires) ..... 71.38″
Factory installed options include: Equipment Hydraulic Package, 28″ cast iron rear wheels (1200 lbs.), and the new "shift-on-the-go" Select-O-Speed.
Weight with 28″ tires ..... 3800 lbs.
Weight with 28″ tires and cast wheels 5000 lbs.

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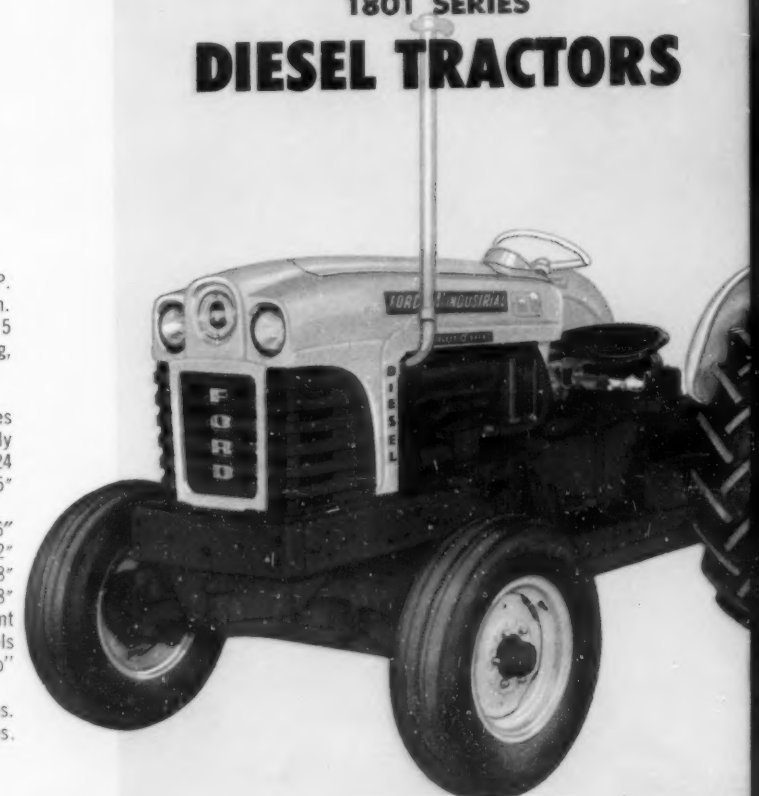
FORD

1801 SERIES DIESEL TRACTORS



For big power requirements

Extra lugging ability, fuel economy. Quick starts even in zero weather!

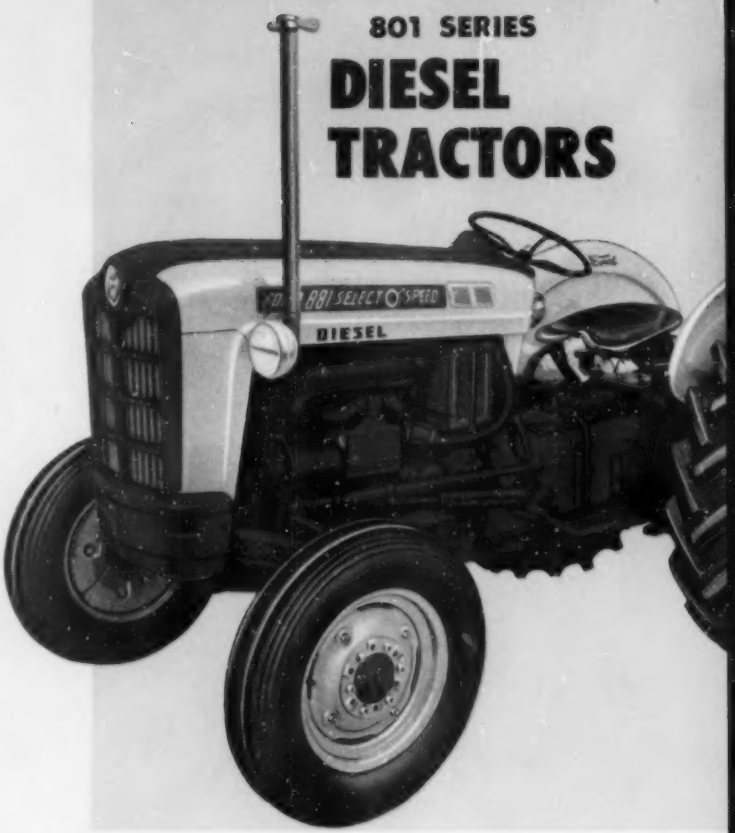
Max. corrected brake H.P. (less accessories @ 2200 rpm; manufacturer's rating)	56 H.P.
Engine displacement	172 cu. in.
Compression ratio	16.8 to 1
Number of models	7
Transmission options	4 or 10-speed "Select-O-Speed"
Heavy duty front end with industrial clutch	Optional
Available without hydraulic system and power take-off	Yes
Front tires	6.00 x 16
Rear tires	10 x 28, 11 x 28 and 12 x 28
Wheelbase at 52" front tread	74.50"
Turning radius, brake locked (w/52" min. tread)	8'11"
Overall height w/12" rear tires	57.29"
Overall length at 52" front tread	120.83"
Overall width at 52" tread	63.88"
Overall width at 76" tread	87.50"
Min. ground clearance (under transmission case)	13.98"

Factory installed options include: Power steering, power adjusted wheels, auxiliary over-under transmission which provides 12 speeds forward when used with 4-speed transmission, and new "shift-on-the-go" Select-O-Speed.

Typical working weight with front and rear tire fill, front and rear wheel weights	5617 lbs.

FORD

801 SERIES DIESEL TRACTORS



ALL NEW FROM FORD FOR '59

- **For any power job**–Utility, All Purpose and Industrial tractors, gasoline or diesel.
- **For any mowing or maintenance job**–Dozens of man and money-saving implements and attachments, including many specialized tools matched to Ford.
- **For any digging job**–10 ft., 12 ft. and 14 ft. backhoes with bucket and stabilizer pad options for all kinds of digging.
- **For any loading job**–Heavy Duty, Extra Heavy Duty and Super-Duty Loaders with 1000 to 2500 lb. rated capacities.

Design, materials and or specifications are subject to change without notice and without liability.

Ford industrial tractors and equipment can help solve problems, beat schedules and save money on your job, too. Why not talk to your nearby Ford Tractor and Equipment Dealer about easy credit terms? Get full details on all of Ford's new industrial line for '59, on the exciting new Select-O-Speed transmission. See him today, or write Industrial Sales Department, Ford Motor Company, Birmingham, Michigan.

YOU SEE MORE FORDS BECAUSE THEY SAVE MORE MONEY!

PRINTED IN U.S.A.

TEAR OUT FOR HANDY REFERENCE

TAKE THE BLINDFOLDS OFF YOUR METER READERS

Lick the problem of fogged registers

HERMETICALLY SEALED REGISTER IS DRIVEN BY THE POWERFUL BOND OF A MAGNETIC COUPLING

You can lick the problem of fogged registers by installing the latest, finest meters ever developed. Get Rockwell Sealed Register Meters. Then dirt and moisture, the arch enemies of your meter readers, will be no more. That's because the register in this meter is hermetically sealed in stainless steel and glass to prevent condensation.

Get these other advances, too. Get the only meter with a powerful magnetic drive . . . the only meter with friction-free instrument type reduction gearing . . . the only meter with but two parts operating in water . . . the only meter without a stuffing box.

And with Rockwell Sealed Register Meters you'll get less wear, less chance for corrosive attack and, of course, easier maintenance at lower cost.

So get all the facts now. Write Rockwell Manufacturing Co., Pittsburgh 8, Pa.

Now available in both ⅝" and full ¾" sizes

SEALED REGISTER METERS

another fine product by

ROCKWELL

B-453

EIMCO CHALLENGES YOU TO

COMPARE THE

FACTS!

NOT THE CLAIMS

	EIMCO 103	CAT D-4	CAT D-6	AC HD-6	AC HD-11	INT. TD-9	INT. TD-15	CASE 1000
Maximum Drawbar Pull (zero track slippage)	33,000	10,700	19,000	15,485	21,980	13,240	23,750	24,000
Torque Converter	Yes	No	No	No	No	No	No	Yes
Master Clutch	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Power shift transmission on all speeds, with oil cooled metallic clutches that never need adjustment	Yes	No	No	No	No	No	No	No
Independently reversible track	Yes	No	No	No	No	No	No	Yes
Hydraulic track take-up	Yes	No	No	No	No	No	No	Yes
Heat-treated alloy steel grouser shoes, keyed to the track links	Yes	No	No	No	Yes	No	No	No
One-piece heat-treated alloy steel track rollers, tapered roller bearings	Yes	No	No	No	No	No	No	No
Equalizer bar of heavy duty heat-treated cast alloy steel, allowing full oscillation of crawler tracks with all attachments	Yes	No	No	No	No	No	No	No
Constantly running power take-off drives, front and rear, to standard SAE specs, with rear take-off not affected by track operation, and independent hydraulic pump drive allowing simultaneous use of hydraulic, winch and hoist accessories.	Yes	No	No	No	No	No	No	No
Front operator's seat for full visibility	Yes	No	No	No	No	No	No	No
Ability to operate forward and backward on up to 90% slopes	Yes	No	No	No	No	No	No	No
Tractor guaranteed for one full year of single shift service	Yes	No	No	No	No	No	No	No

FOR PROOF OF EIMCO 103 SUPERIORITY

WEIGHT BARE TRACTOR, POUNDS	15,000	10,910	17,603	12,600	20,500	11,935	22,540	13,200
H.P. — FLYWHEEL	100	63	93	66	99	71	105	90
TRACK GAUGE, INCHES (STD.)	60	60	74	60	74	60	74	60
STD. TRACK SHOE WIDTH, INCHES	16	13	16	13	16	13	16	16
LENGTH OF TRACK ON GROUND, INCHES	88	61	85⅝	66⅞	85⅝	73	89⅝	79
TOTAL TRACK AREA, SQ. INCHES	2,820	1,589	2,744	1,739	2,744	1,896	2,858	2,528
GROUND PRESSURE, PSI.	5.3	6.9	6.4	7.3	7.5	6.3	7.9	5.2
TRACK ROLLER DIAMETER, INCHES	8	8	8	7⅝	7½	N.A.	10½	6
TRACK RAIL WIDTH, INCHES	1⅞	1½	1¾	1⅝	1¾	N.A.	N.A.	1⅞
NUMBER TRACK ROLLERS, EACH SIDE	6	4	6	5	6	5	6	5
TRACK BOLT DIAMETER, INCHES	⅞	⅛	⅞	1⅛	⅞	1⅛	⅞	1⅛
TRACK BUSHING DIAMETER, INCHES	2⅝	2	2⅝	2	2⅝	2⅝	2⅝	1¾
TRACK PIN DIAMETER, INCHES	1 11/32	1⅜	1⅜	1¾	1⅜	1⅜	1½	1¼
SPROCKET PITCH DIAMETER, INCHES	32½	29¼	30½	28⅛	31½	28¼	30½	24½
GROUND CLEARANCE, INCHES	17	11½	12½	11¾	12½	10⅞	11	16

N.A. — not available

Above is from manufacturer's data and other sources believed to be reliable [illegible]

IT'S A FACT . . . not a claim . . . that here is a MODERN line of tractors that makes all other crawler-tractors old-fashioned!

Other exclusive features include Unitized "Stresss Flow" Construction, for far greater strength and rigidity; Self-cleaning Air Cleaner that completely eliminates ordinary routine cleaner maintenance and others, far too numerous to list here. Write for details and specifications on all the advanced engineering features of the modern Eimco 103 line of crawler-tractors.

AVAILABLE IN FOLLOWING MODELS:

103 — TRACTOR AND DOZER
123 — FRONT END LOADER
133 — STEEL MILL FEL
143 — LOG LOADER

ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1901

THE EIMCO CORPORATION

EXPORT OFFICE: 51 - 52 SOUTH STREET, NEW YORK, N. Y.

TRACTOR LOADER DIVISION
824 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

★

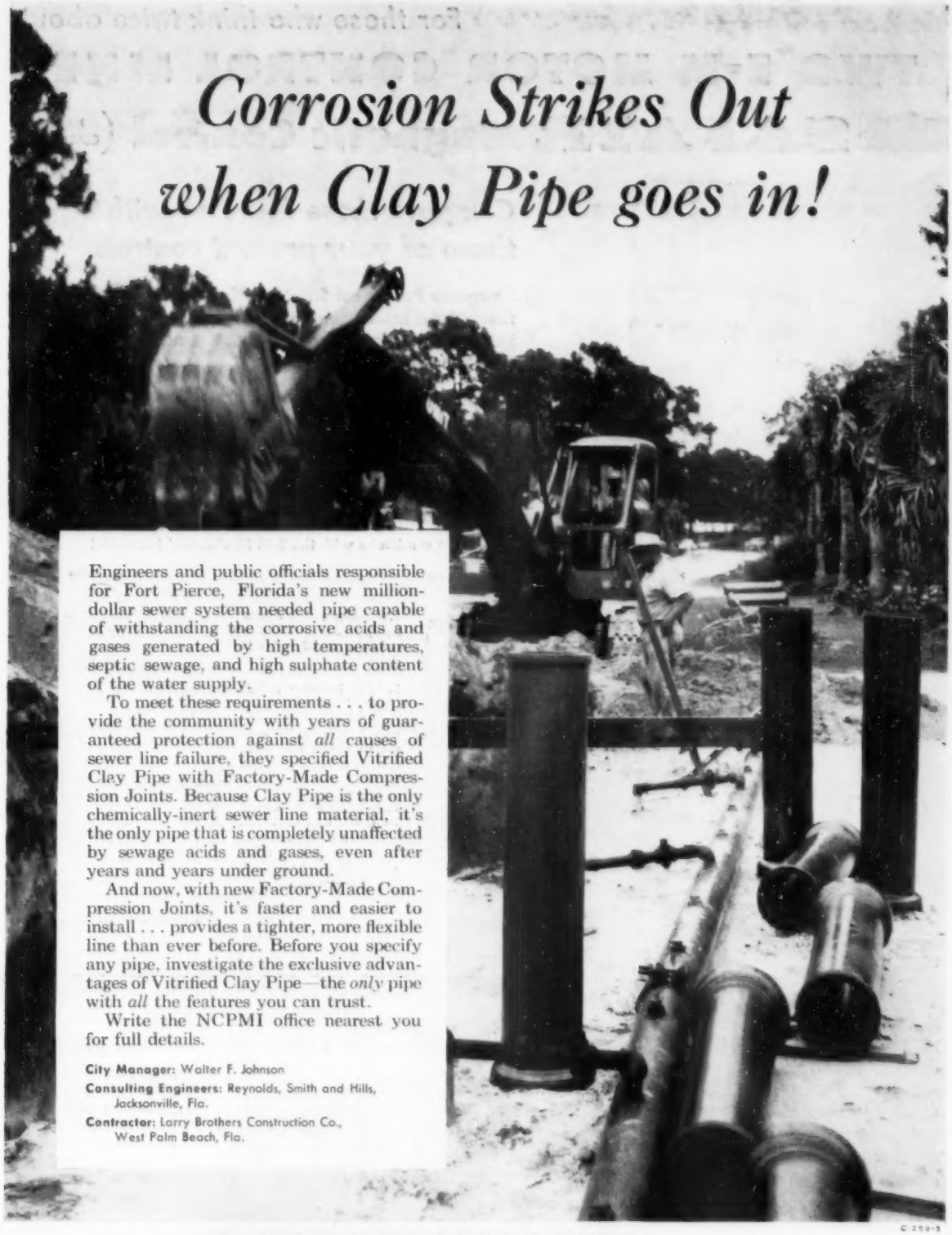
H. H. Hester is a graduate of Texas A & M College and has been Street Superintendent for Fort Worth since 1940. For several years he also was responsible for garbage collection and disposal, as well as for supervision over the municipal garage and shops.

His duties as Street Superintendent include street cleaning with day and night crews; weed cutting; maintenance of 658 miles of dirt and gravel streets, 312 miles of permanent pavement, 90 miles of semi-permanent pavement and 472 miles of penetration type surfacing; asphalt plant operation; repair of all utility cuts for water and sewer lines for street excavation; storm drain and inlet maintenance; bridges, culverts, overpasses, underpasses and tunnels; small storm drains and all street signs.

One of the most popular projects in the City he says, is the washing of sidewalks in the uptown area during the summer months. The most difficult job is maintaining the 400 miles of penetration type surfaced streets that are from 25 to 30 years old.

Mr. Hester has been active in the APWA for many years, having served as State President and as State Representative; at present, he is Director of Region No. 7. He also belongs to the ASCE. He has devoted much time to Boys Club work and has received many citations. He has been a Director of the Panther Boys Club of Fort Worth for 25 years. In addition, he has served on the Board of Stewards of the First Methodist Church for 26 years. He and Mrs. Hester have no children. His hobby is golf, plus collecting rocks that he builds into fences, patios, gardens, etc.

Corrosion Strikes Out when Clay Pipe goes in!



Engineers and public officials responsible for Fort Pierce, Florida's new million-dollar sewer system needed pipe capable of withstanding the corrosive acids and gases generated by high temperatures, septic sewage, and high sulphate content of the water supply.

To meet these requirements . . . to provide the community with years of guaranteed protection against *all* causes of sewer line failure, they specified Vitrified Clay Pipe with Factory-Made Compression Joints. Because Clay Pipe is the only chemically-inert sewer line material, it's the only pipe that is completely unaffected by sewage acids and gases, even after years and years under ground.

And now, with new Factory-Made Compression Joints, it's faster and easier to install . . . provides a tighter, more flexible line than ever before. Before you specify any pipe, investigate the exclusive advantages of Vitrified Clay Pipe—the *only* pipe with *all* the features you can trust.

Write the NCPMI office nearest you for full details.

City Manager: Walter F. Johnson
Consulting Engineers: Reynolds, Smith and Hills, Jacksonville, Fla.
Contractor: Larry Brothers Construction Co., West Palm Beach, Fla.

C-259-3

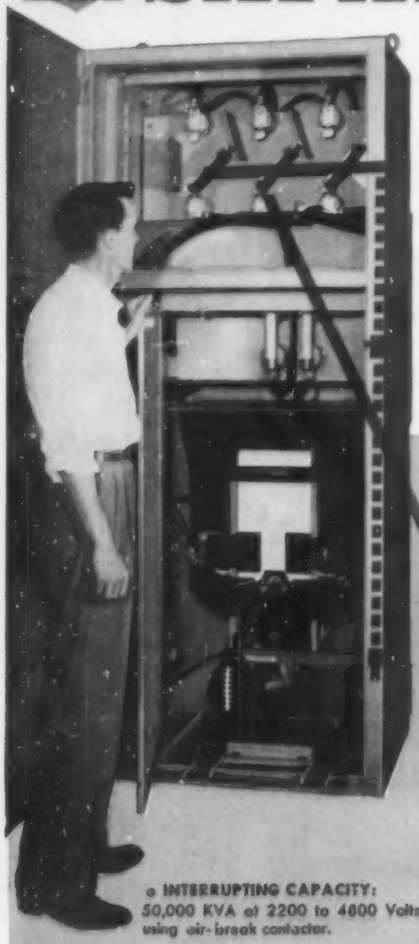
Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 1401 Peachtree St., N. E., Atlanta 9, Georgia

For those who think twice about

TWO E-M MOTOR CONTROL LINES

E-M SAFAIR Magnetic Control (NEMA CLASS E-1)

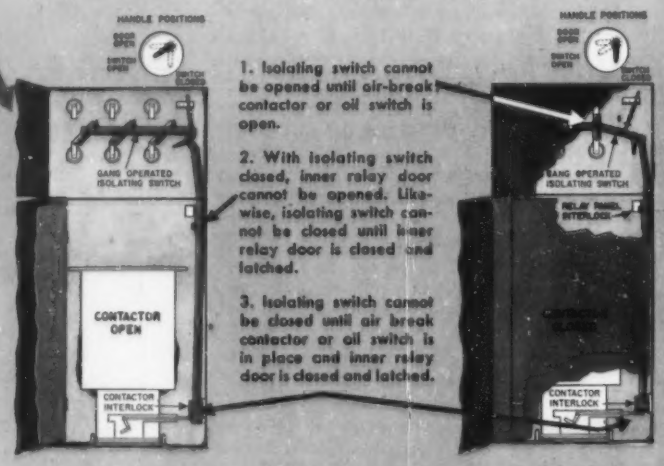


o INTERRUPTING CAPACITY: 50,000 KVA at 2200 to 4800 Volts, using air-break contactor.

Compare these features with those of your present controls

1. **Complete Personnel Safety** with a foolproof system of mechanical interlocking between gang-operated isolating switch, oil switch or air-break contactor, and compartment doors.
2. **Complete Motor And Control Protection.** Skillfully engineered and applied components are carefully coordinated to protect both motor and control over complete design range of overload and fault conditions.

You can't make a mistake with the E-M Mechanical Interlock!



1. Isolating switch cannot be opened until air-break contactor or oil switch is open.

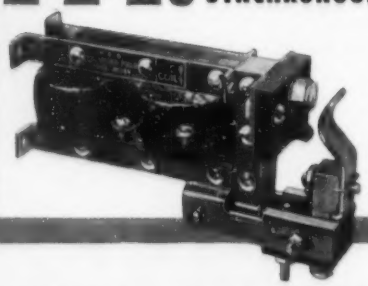
2. With isolating switch closed, inner relay door cannot be opened. Likewise, isolating switch cannot be closed until inner relay door is closed and latched.

3. Isolating switch cannot be closed until air break contactor or oil switch is in place and inner relay door is closed and latched.

E-M SAFETY-GANG ISOLATING SWITCH of SAFAIR Control is externally operated, internally interlocked as detailed in color and diagrams above, right.

SAFAIR features a 50,000 kva (NEMA Class E-1 maximum rating) air-break contactor suitable for repetitive motor starting and rapid switching in a complete line of squirrel-cage and wound-rotor induction motor controls and synchronous motor controls.

PFR *for Simple, Reliable SYNCHRONOUS MOTOR CONTROL



Safair- and Safuse-controlled synchronous motors pull into step smoothly and powerfully every time. E-M-invented *Polarized Field Frequency Relay system of synchronous motor

3300-TPA-2189

ELECTRIC MACHINERY

Originators of the safety-gang

their men and motors...

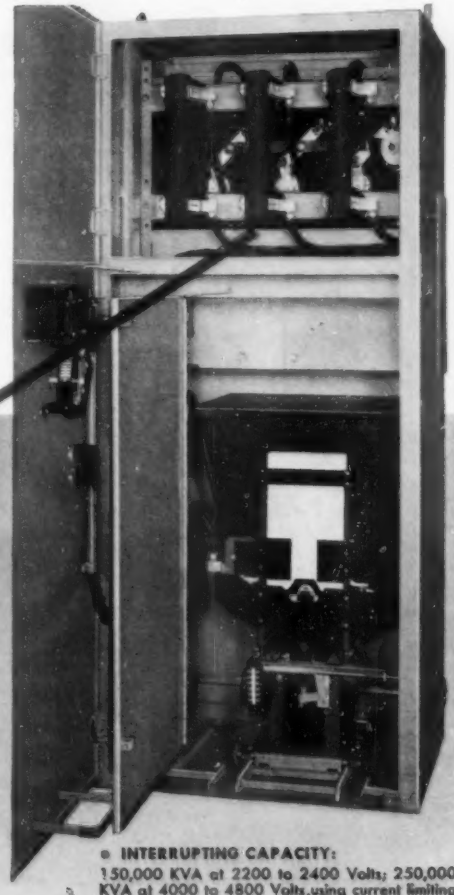
OFFER COMPLETE PROTECTION!

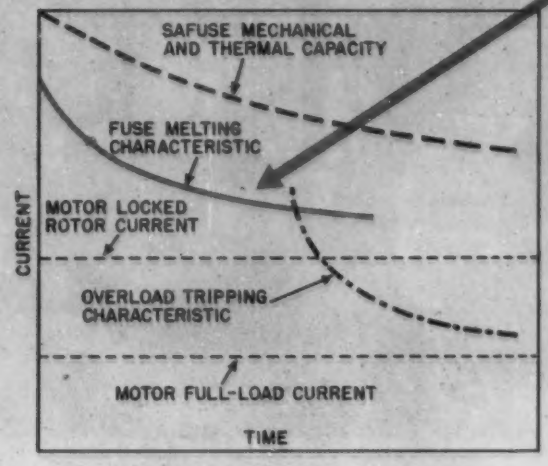
E-M SAFUSE Magnetic Control (NEMA CLASS E-2)

3 **Complete Front Accessibility.** Controls may be placed in rows, back-to-back or back-to-wall—no access required to back or sides.

4 **Complete Space Utilization.** Imaginative E-M engineering has provided a highly compact control design without compromise on safety or performance, and with provision to accommodate modifications.

5 **Complete Modification Line.** You can tailor the control to fit your exacting requirements—nearly 100 options and special features available.





● **INTERRUPTING CAPACITY:** 150,000 KVA at 2200 to 2400 Volts; 250,000 KVA at 4000 to 4800 Volts, using current limiting fuses with air-break contactor or oil switch.

starting and synchronizing is sensitive to the electrical condition of the field winding, applying field excitation at proper rotor angle for maximum synchronizing torque with minimum current inrush . . . and it's coupled with E-M's modern field failure protective system.

FAST ACTING FUSES *plus* E-M Safety-Gang Isolating Switch in SAFUSE are the best possible combination for complete motor and control protection thru NEMA Class E-2 maximum ratings. The current limiting fuses provide short circuit protection and are carefully coordinated with overload relays as shown in diagram above.

Complete information and helpful application data are available from your E-M Field Engineer. Call him and write the factory for publications 242A and 249.

SAFUSE GIVES YOU CHOICE OF AIR-BREAK CONTACTOR OR OIL SWITCH

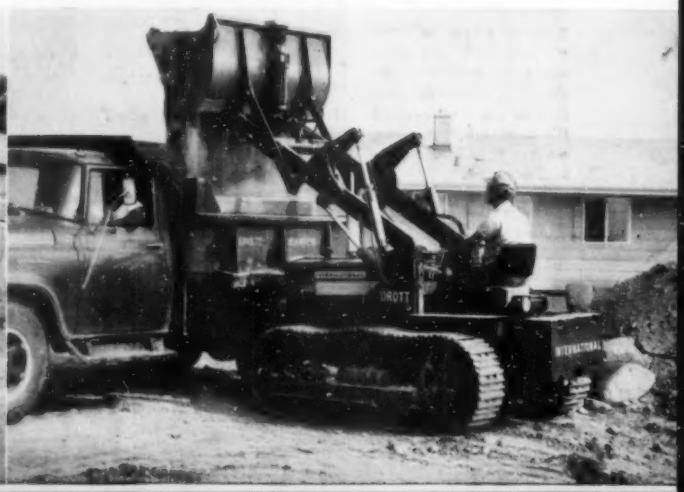
For highly repetitive duty use the roll-out air break contactor. But for less frequent starting—or in areas of severe dust, dirt, moisture, or corrosive fumes—the roll-out oil switch is recommended.

E-M MFG. COMPANY MINNEAPOLIS 13, MINNESOTA

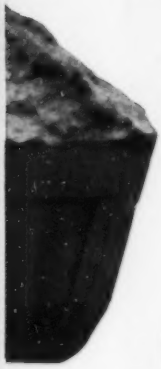
disconnect high-voltage fused control

Automatic hydraulic self-leveling bucket gives the operator a clear view with the International Wagner loader —unobstructed by cumbersome mechanical linkages. Big, ⅝-cu yd bucket is 64 inches wide, has 3,500-lb capacity. Notice how unsightly external hose connections are eliminated by T-340 internal pump design.

New International Drott Four-in-One. Only the new T-340 offers this versatile, high-production unit in the utility crawler field! Left below, showing exclusive clamshell action for "surrounding" materials, or dozing close to green foundations without excessive ground pressure. Right, bottom-dump action provides 9 ft, 6-inch under-bucket clearance. Also, use the Four-in-One as a regular bucket with ¾ cu yd (SAE struck) capacity; a scraper for inch-close grading accuracy; or a bulldozer with adjustable, radius-controlled moldboard for live, earth-rolling action. Parallelogram linkage holds bucket level from ground level to dump height.



already, they're calling it the



"terrific" T-340

New 45 hp* International Crawler leads its field in *POWER · SPEEDS · STEERING · EQUIPMENT!*

Reports from new T-340 users express amazement at its capacity . . . *its push and pull power*, compared with what they expected from a 31 drawbar hp rating. But when you measure the T-340 against its field, you see the reasons!

- **A quiet, smooth-running, 4-cylinder engine** with a proven pedigree for stamina and fuel economy.
- **Characteristic IH power-weight ratio,** delivering 95 per cent of the T-340's *built-in* operating weight of 5,600 lb as pull at the drawbar.
- **Job-matched speeds.** Only the T-340 in its power class offers Torque Amplifier Drive—providing *two* speeds in each of the five regular gears, letting you boost pull power up to 45 per cent, *on-the-go*, without declutching. Or, equip the T-340 with Fast Reverser, giving you *five reverse speeds*, each 22 per cent faster than the corresponding forward gear speed.
- **High-capacity, internal hydraulic pump,** gives instant-quick, fast-cycle equipment control.
- **Exclusive new planetary steering and final drive** —quick, easy pivot or "feathered" turns.

*Maximum flywheel hp

Measure the new T-340 by either price or performance . . . you'll quickly see why it's easily today's top value in the utility tractor field. See it *soon!*

Ask your IH Dealer to demonstrate . . . see for yourself how smooth, 4-cylinder power, planetary-type steering, balanced power-weight ratio and other features put the T-340 at the head of its class! For name of the IH dealer nearby, and descriptive literature, write International Harvester Company, Dept. PW-9, P. O. Box 7333, Chicago 80, Illinois, *today*.

See Your
INTERNATIONAL HARVESTER Dealer

International Harvester Products *pay for themselves in use* —Farm Tractors and Equipment . . . Twine . . . Industrial Tractors and Equipment . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois.

New International hydraulic bullgrader, is raised, lowered, tilted, and angled to right or left—all with fingertip hydraulic control. Blade is 85-inches wide and 25 inches high, plus a 7-inch center spillboard. Can be used in combination with scarifier, winch, and other rear-mounted equipment.

International Wagner Loader and backhoe can be mounted separately or in combination to form a highly efficient trenching, backfilling, and loading unit. Backhoe can be equipped with regular, mole's paw, bell hole, cemetery, or heavy-duty street repair bucket.

As time goes by, Rust-Oleum long wear assures lower cost over-the-years protection!

Rust-Oleum is distinctive as your own fingerprint. Accept no substitute.

Rust-Oleum's *unusual* resistance to extremes in rust-producing conditions—from sun and salt water to humidity, moisture, fumes, and weathering—assures you of lasting beauty. Long wear made possible, because Rust-Oleum's *specially-processed fish oil vehicle* works down through the rust into the tiny, microscopic pores in bare metal to STOP RUST. Important savings are realized by applying Rust-Oleum 769 Damp-Proof Red Primer *over rusted metal* after scraping and wire-brushing to remove rust scale and loose rust—as costly surface preparations are usually eliminated. See how Rust-Oleum can save you money... in your plant, or your home. Prompt delivery from Industrial Distributor stocks. Write for illustrated literature with color charts.

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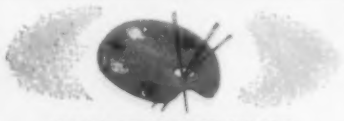

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Rust-Oleum finish coatings in Aluminum, White, Red, Gray, Green, Blue, Black, and Yellow provide double protection for tanks, machinery, girders, equipment, metal sash, wire fences, etc. Write for illustrated literature with color charts.

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Rust-Oleum and Stops Rust are brand names and registered trademarks of the Rust-Oleum Corporation.

Radioactive tracing studies prove Rust-Oleum penetration through rust to bare metal.

BADGER'S COMPOUND WATER METER ASSURES FULL REVENUE FOR ALL WATER DELIVERED

Wherever water flow rates fluctuate considerably during the day — in schools, factories, hotels, theaters, apartment houses, dairies, laundries — Badger's compound meter assures economical, efficient service.

This compound meter combines Badger's disc and turbine meters to provide accurate registration at all rates of flow. You get the full revenue to which your water department is entitled for water actually delivered.

It is the industry's only compound meter where only one side operates at a time. A patented balanced compounding valve directs small streams through the disc meter, large streams through the turbine side... for accurate measurement of all rates of flow, less wear and longer service life.

Write for complete details now.

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Progressive Jefferson Parish, La. Reports on New Container System

Schools and Other Public Buildings Are Served By 18 Yd. DUMPMASTER

Jefferson Parish, La.: In November of 1958, this progressive community installed an 18 cu. yd. DEMPSTER-DUMPMASTER and put 24 three cu. yd. steel containers into service, as the first step in streamlining refuse collection in the parish.

Commissioner Ray Conden and Assistant Director Ray Patron are shown in front of the Dumpmaster.

Because of climatic conditions, storage of refuse has always posed a sanitation problem in this area. Ten months ago, under the leadership of Sanitation Commissioner Ray Conden and Assistant Director Ray Patron, the first portion of a long-range plan was executed with the installation of the new system.

Commissioner Conden directed that the schools receive the first of the sanitary, fireproof containers. The service was then extended to other public buildings, until today, 38 containers are in service.

BEFORE: The yard of this parochial school was constantly littered with unsightly trash.

The DEMPSTER-DUMPMASTER prepares to dump its big payload of compacted refuse into the modern Jefferson Parish incinerator.

SCHOOL OFFICIALS PLEASED

Officials of both public and parochial schools have expressed delight with the enclosed storage of garbage and refuse. Many report a marked reduction of flies, rodents, odors and scattering of trash.

ECONOMY BIG FACTOR

"We are all aware of the many sanitary values of enclosed refuse storage, which is the primary reason for purchasing this type of system," Director Ray Patron pointed out, "but our cost sheets — based on several months of operation — prove that we are saving important amounts of money.

AFTER: Two three-yard Dumpmaster containers keep refuse enclosed, reduce flies, rodents and odors.

"The savings in time, money and manpower have enabled us to direct more effort to the important area of residential collection; I am convinced this addition to our service has resulted in specific benefits to every man, woman and child in the parish, while saving tax dollars."

DAILY SERVICE

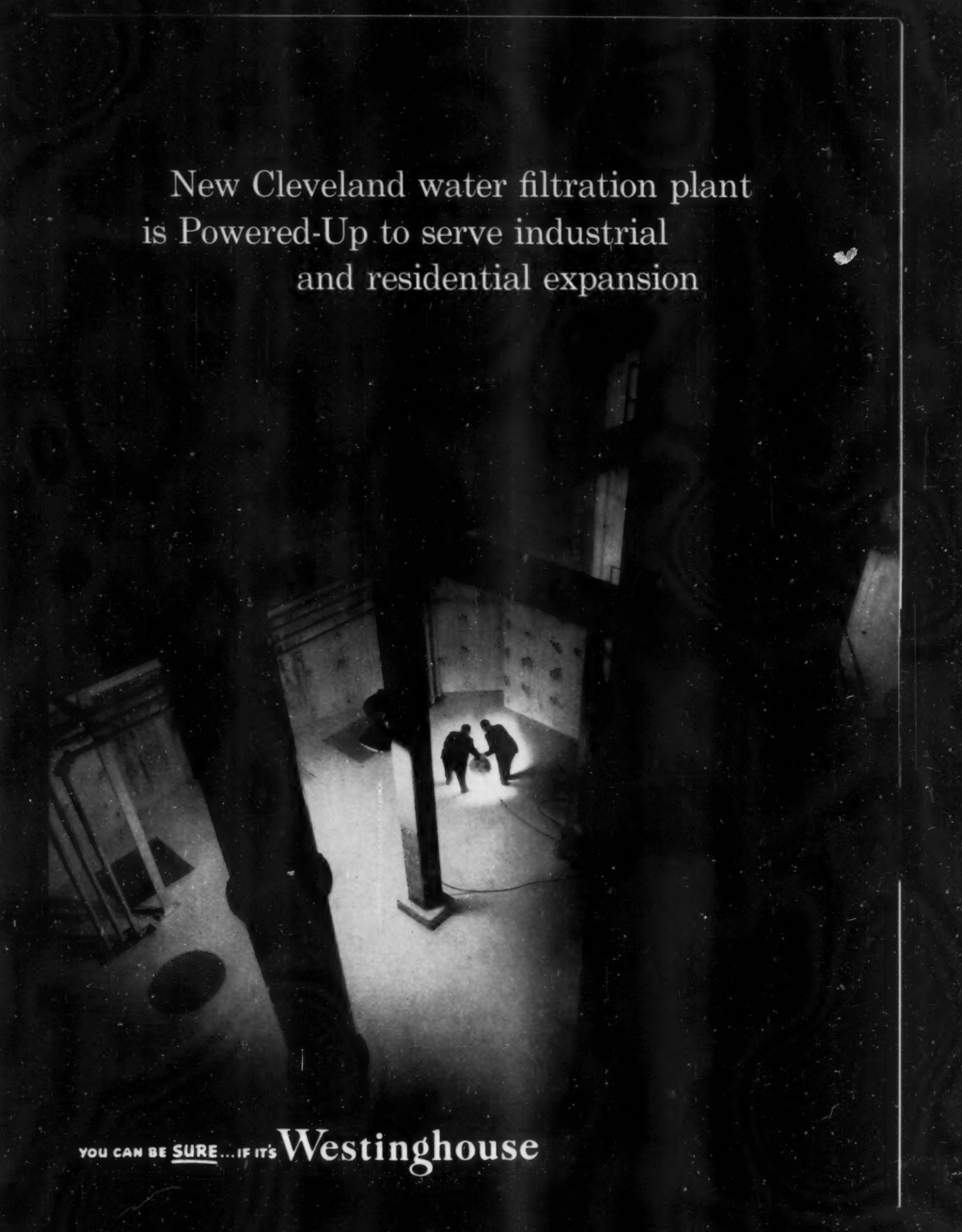
Most of the 38 locations receive daily service as the DEMPSTER-DUMPMASTER makes its rounds, mechanically picking up each container, dumping the contents into its body and hydraulically compacting the refuse. The refuse is then emptied into the modern Jefferson Parish incinerator for disposal.

The Dumpmaster has proven itself in countless cities, large and small. If you would like the new brochure that describes this economical system, write today.

Patents Pending

DEMPSTER DUMPSTER® SYSTEMS

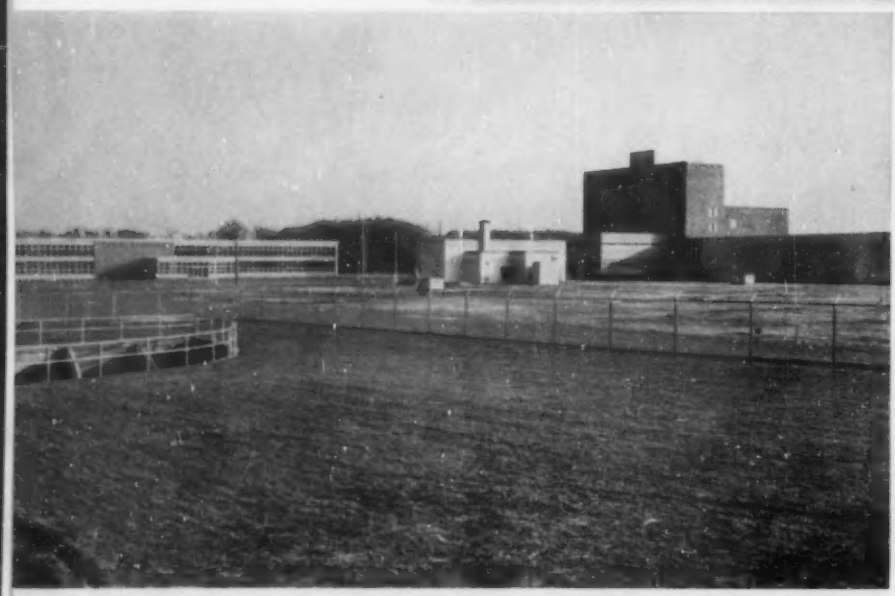
DEMPSTER BROTHERS
Inc.
Knoxville 17, Tenn., Dept. PW-9


New Cleveland water filtration plant
is Powered-Up to serve industrial
and residential expansion
YOU CAN BE SURE... IF IT'S Westinghouse

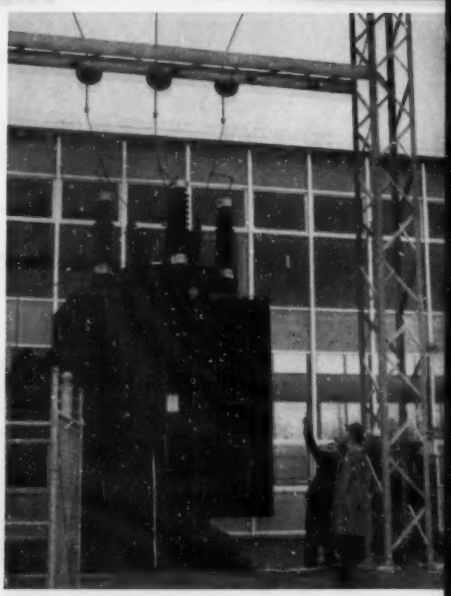
Cover photo:
View of raw water pump suction wells illuminated by Westinghouse VEK-16 floodlighting.

Project group discussing layout of Crown Filtration Plant includes J. E. Hrovat, Vice President of Engineering, Doan Electric Co., Electrical Contractors; E. E. Croushore, Westinghouse Construction Sales Engineer; L. O. Meyer, Branch Sales Manager, WESCO, Cleveland; Dan Kasych, Chief Engineman, Pump Building; G. L. Baughman, Chief Electrical Engineer, Havens and Emerson, Consulting Engineers; S. C. Simmermacher, Chief Mechanical Engineer, City of Cleveland; M. B. Trimble, Westinghouse Construction Sales Engineer; E. S. Goulder, President, Doan Electric Co.; and H. M. Stafford, Salesman, WESCO, Cleveland.

J-94123-R2



Over-all view of Crown Filtration Plant, Cleveland, Ohio. Pump building is at left and the filter building at right. Westinghouse OV-20 street lighting was provided for plant entrances and roadways.



Dan Kasych and E. E. Croushore examine one of the two Westinghouse 5000-kva power transformers which step incoming 34.5-kv service down to 4160 v for main pump drives.

Westinghouse system provides for 100% electrical load increase in new water pumping station

The new Crown Filtration Plant was designed to meet the growing need for water supply in the westerly suburbs of Cleveland, Ohio, and, as an important part of that planned expansion, the Westinghouse electrical system presently installed provides for 100% load increase without adding to the system.

The pumping station-filtration plant is located on a 55-acre site and is the newest addition to the city's expanding water supply system. Construction was started in 1953 and completed in 1958, and represents nearly a $20,000,000 investment. Present plant capacity is 50 mgd; but, because of anticipated future requirements, the plant has space and provision for additional equipment to provide capacity of 100 mgd.

Raw water is obtained through a crib 2½ miles offshore in Lake Erie. The water from the crib is carried through a connecting tunnel to a raw water well, where its handling is taken over by submerged raw water pumps. Treatment and flow of the water from this point through the filtration plant are automatic and exactly controlled, leading finally to a 15-million-gallon filtered water reservoir located in the southwest corner of the plant area. Six service pumps deliver the water from the reservoir to both the low service zone and the first high service zone supplied by the Crown plant.

The major electrical elements supplied by Westinghouse to Power-Up this filtration operation include:

Two 5000-kva power transformers—to step utility service from 34.5 down to 4.16 kv.

Main metal-clad switchgear—to control and distribute power to motor starters (for L.S.) and provide for starting of H.S. motors (1750 hp).

Dry-type power center—to provide 480-v service to plant auxiliaries.

Westinghouse lighting throughout the plant area, including fluorescent, incandescent, street lighting and floodlighting.

In addition, Westinghouse supplied the many panelboards required in the plant's operation.

The planned Powering-Up of the Crown Filtration Plant means it can meet all foreseeable future requirements with a minimum of modification. Additional water handling and treating facilities can be installed in areas already provided for them. And all such additional equipment can be operated without adding to the existing electrical distribution system.

Cleveland now has surplus water capacity in its plants, and is in an enviable position with an almost unlimited supply of good Lake Erie water. It is ready and willing to construct additional facilities to process and deliver this water whenever the need for a greater supply for new industry is indicated.

(*contd.*)

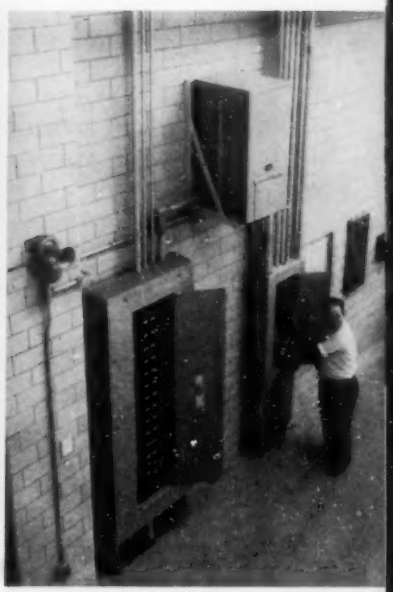
YOU CAN BE SURE...IF IT'S **Westinghouse**

J-94123-R3

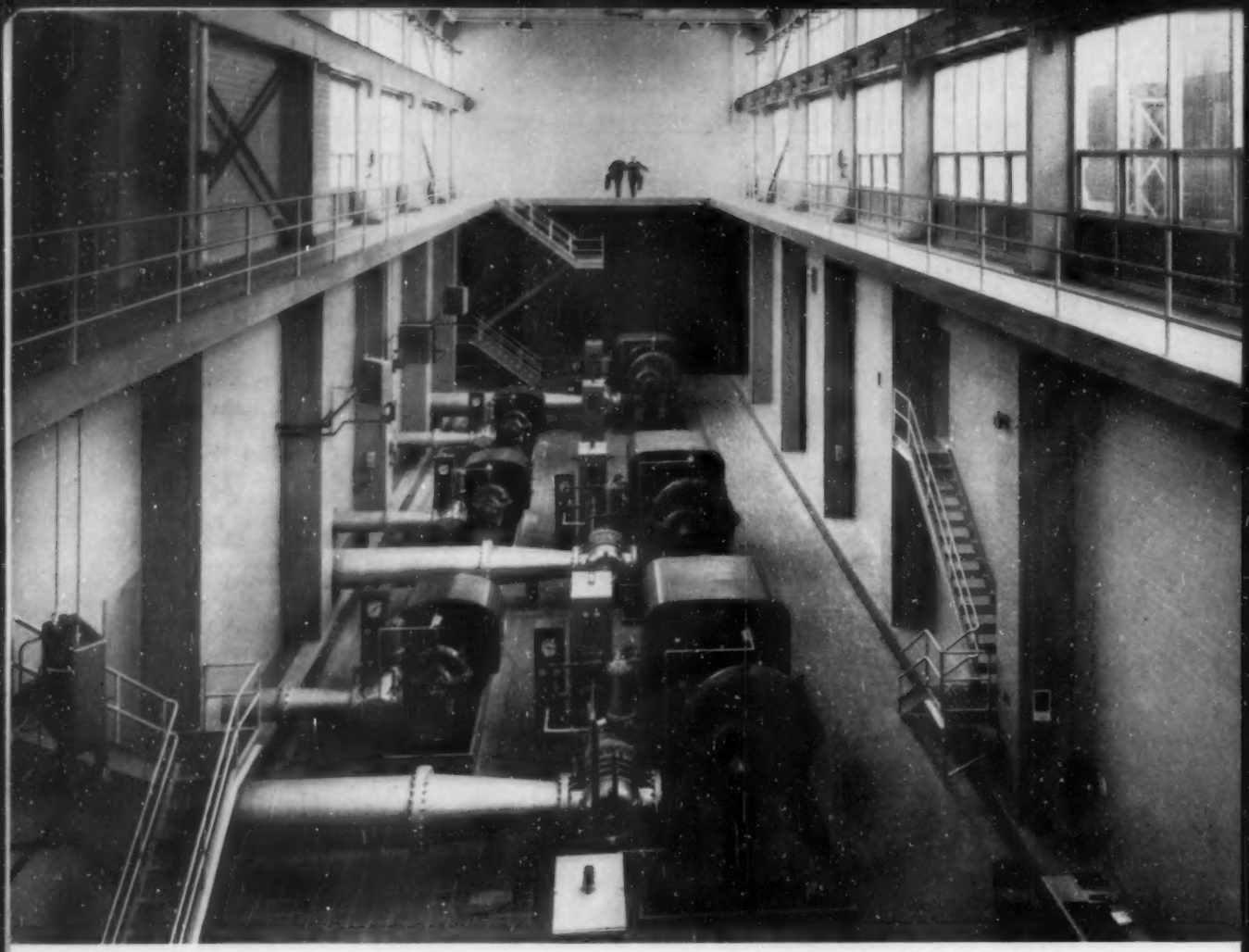
View in main switchgear room with G. L. Baughman, M. B. Trimble and S. C. Simmermacher examining Westinghouse metal-clad switchgear. Lineup at right contains main incoming line breakers, bus tie breaker, reactor starters for high service pump motors, and feeder breakers for power center and low service pump motor starters. Five-kv bus duct overhead provides connections from metal-clad switchgear to Ampgard* high-voltage fused starters at left.

*Trade-Mark

Dan Kasych inspects switchgear room. Westinghouse 225-kva power center utilizes dry-type transformers and DB low-voltage air circuit breakers to supply power panels throughout pump building. Room lighting is Westinghouse 2 SPC-75 slimline fluorescent luminaires.



Westinghouse CDP power distribution panelboard and wall-mounted 37.5-kva dry-type transformer feeding NLAB lighting panelboard.



Section of main pump floor showing the three 25-mgd first high service pumps and three 8-mgd low service pumps which are presently installed. Metal-clad switchgear cubicles and Ampgard high-voltage starters for these and two additional future pumps of each rating are installed in the main switchgear room. High bay mercury-vapor lighting is provided by Westinghouse Millite® luminaires.

(contd.)

Electrical system provides for 100% load increase

Powering-Up electrically for future growth can mean important benefits and savings for you. For further information, call the Westinghouse electrical construction engineer nearest you, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94123-R4

OWNER: City of Cleveland, Ohio
CONSULTING ENGINEER: Havens and Emerson, Cleveland, Ohio
CONSULTING ARCHITECT: Small-Smith-Reeb and Draz, Cleveland, Ohio
GENERAL CONTRACTOR: The Hunkin-Conkey Construction Co., Cleveland, Ohio
ELECTRICAL CONTRACTOR: Doan Electric Co., Cleveland, Ohio
WESTINGHOUSE DISTRIBUTOR: Westinghouse Electric Supply Co., Cleveland, Ohio

Over 250 Pages Westinghouse Data in Sweet's Construction File.

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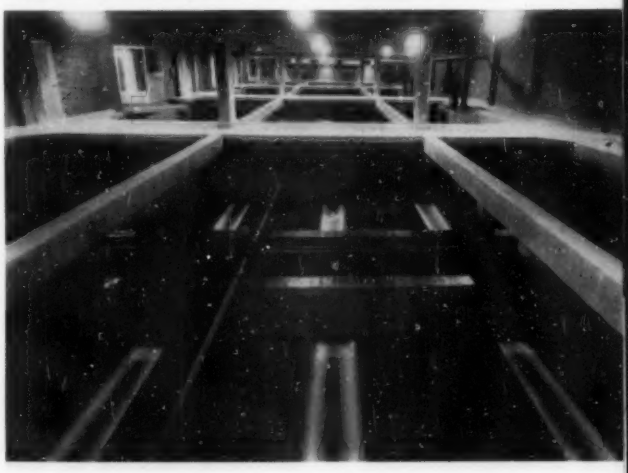
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

View in filter building showing row of clarified water filter beds. Under average flow conditions, the 12 filters in the plant will pass a total of 50 mgd. Lighting is supplied by Westinghouse VEK-16 floodlights.



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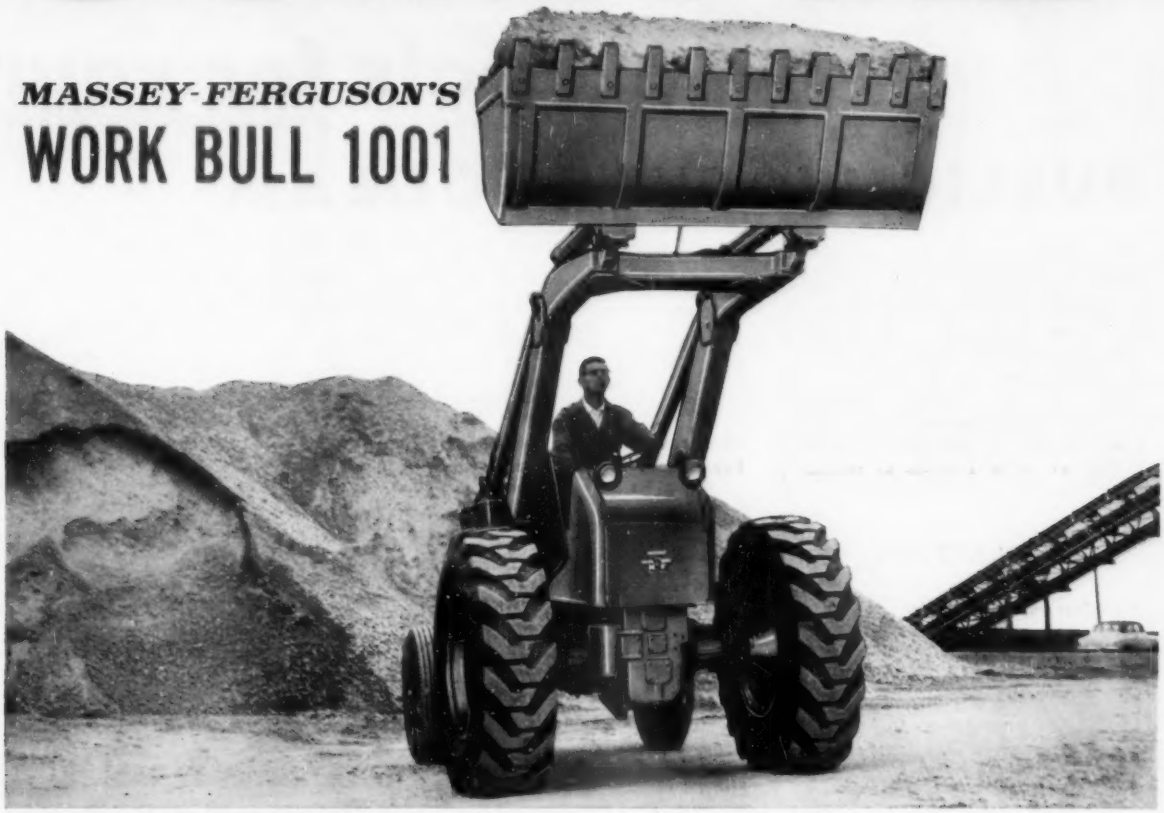
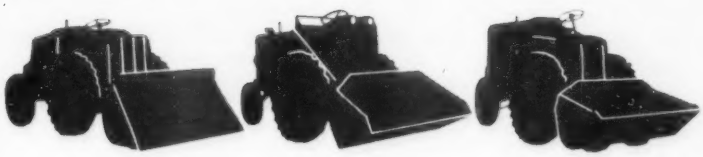
MASSEY-FERGUSON'S WORK BULL 1001



against any Tractor Shovel in its class!



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Yes, we invite you to compare Massey-Ferguson's Work Bull 1001 against all the rest. You'll soon be convinced of its superiority . . . of its profit-making and time-saving advantages on the job. You'll see why it can outperform costly, single-purpose machines. Ask your Massey-Ferguson Industrial Dealer for a demonstration.

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NEW LISTINGS

Manufacture of Steel Line Pipe Ranging from ½ to 36 in.

29. This 40-page catalog describing the manufacture of steel line pipe is divided into sections dealing with continuous weld pipe, electric resistance weld pipe and electric weld pipe. Check the reply card or write Tubular Sales Dept., Kaiser Steel Corp., P. O. 58, Oakland 12, Calif., for your copy.

Sparjair Units—Package Contact Stabilization Plants

31. Design factors and criteria, drawings and general details of the Sparjair package plant are covered in Bulletin 19-S-94. Check the reply card or write Walker Process Equipment Inc., Aurora, Ill., for your copy.

Self-Propelled One Man Operated Hydra-Hammer

46. Hydra-Hammer breaks concrete pavement, tamps backfill, rock or heavy aggregate, cuts asphalt and drives highway guard rail posts. Check the reply card or write Ottawa Steel Div., Young Spring and Wire Corp., Ottawa, Kans., for literature.

Facts on Modern Placement of Concrete Through Air Entrainment

51. Covered in this 48-page manual are answers to questions on the placing of concrete through air entrainment and its cost and other data. Check the reply card or write Autolene Lubricants Co., Industrial and Research Div., Denver 9, Colo., for this Manual.

Dump Bodies, Dump Trailers and Hoists in Hercules Catalog

61. Single and tandem axle, light, medium and heavy-duty contractor-type dump bodies, dump trailer units and hydraulic hoists—all of which embody new design and construction features—are described in catalog available from Hercules Steel Products Co., Galion, Ohio.

Fluidics—The Science of Fluid Processes

140. Applications of Fluidics range from reactions to storage, from water treatment to waste treatment and from design and development to project engineering. The specific areas of use are covered in detail and each section is illustrated with application photos and concise engineering data in bulletin. Check the reply card or write Pfaudler Div. of Pfaudler Permutit Inc., 1094 West Ave., Rochester, N. Y., for Bulletin 980.

Tomorrow's Lighting on Today's Streets

79. Bulletin GEA-6989, 12 pages, illustrates how several cities, both large and small, met the challenge of poorly lighted downtown areas. Check the reply card or write General Electric Co., Schenectady 5, N. Y., for data on mercury, fluorescents and filament lighting luminaires.

Clamps, Couplings, Saddles and Fabrications for All Types of Pipe

87. A net price book that gives product sizes, details, material specifications and the net price of each of all standard products is available from Smith-Blair, Inc., 535 Railroad Ave., South San Francisco, Calif. Check the reply card for this 44-page catalog.

A-C Crawler Tractor With Turbocharged Diesel Engine

113. Specifications and standard equipment of the Allis-Chalmers HD-21 crawler tractor are covered in Catalog MS-1243 available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis. Check the reply card for full details.

Metal Packing for Pumps, Engines and Compressors

118. Comprehensive data for correct selection, application and installation of metal packing and complete explanatory illustrations are included in Catalog AD-166 available from The Garlock Packing Co., 438 Main St., Palmyra, N. Y. Check the reply card for this 24-page catalog.

Compaction Equipment and Grader, Scraper and Bulldozer Blades

123. Steel wheel, self-propelled pneumatic, pull type pneumatic and tamping rollers are covered in bulletin from Shovel Supply Co., P. O. Box 1369, Dallas 21, Texas. Also included are blades and cutting edges. Check the reply card.

Submersible Pumps in Worthington's New Ultra-High Flow Design

127. Submersible pumps that are primarily designed for use with deep settings and high heads are covered in catalog from Worthington Corp., Harrison, N. J. Check the reply card.

How Armco Foundation Products Meet the Needs of Engineers

129. Products covered in Bulletin FB-7959 are Hel-Cor pile shells, steel pipe piles and steel caissons. Check the reply card or write Products Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio.

Automatic Portable Steam-Jet Cleaner

136. Technical Bulletin SC-500 describes the 100 gph Speedysteam, steam-jet cleaner and is available from Steam Generator Div., Pantex Mfg. Corp., P. O. Box 660, Pawtucket, R. I. Check the reply card for typical, in-use photographs and details on design and operation.

Illustrated Catalog on 30-ton Lorain Moto-Crane

104. A colorful catalog describing the 30-ton Lorain Moto-Crane is available from The Thew Shovel Co., Advertising Dept., Lorain, Ohio. Check the reply card.

Submersible Pumps for Municipal Water Supply and Reservoir Pumping

141. Detailed cross-section drawings plus colored illustrations of the many and varied uses and applications of Layne submersible pumps make up this bulletin from Layne & Bowler, Inc., Memphis 8, Tenn. Check the reply card.

Elliptical Concrete Pipe for Sewers and Culverts

168. A 4-page bulletin is available from United States Concrete Pipe Co., 1500 Union Commerce Bldg., Cleveland 14, Ohio, on the use of elliptical pipe to obtain round pipe flow equivalents in certain areas. Check the reply card for diagrams, data charts and tables that fully describe elliptical pipe sizes and compute discharge flow rates for the full range of pipe sizes.

On the Spot Embossed Labels

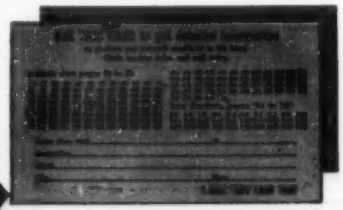
145. An all new, lightweight hand embossing machine is a precision made instrument and a wide variety of ½-in. wide tapes are available. Check the reply card or write Dymo Corp., 2546 Tenth St., Berkeley, Calif., for full details.

Guide Book Information for Emergency Power

153. This book covers what to do when commercial power fails in a fire, flood, hurricane, war and other national disasters. Check the reply card or write Caterpillar Tractor Co., Engine Div., Peoria, Ill., for a copy of "The Four Horsemen of the Space Age."

Versatility, Compaction Force Account For Extra Packer Capacity

159. The many advantages of this modern packer unit have been combined into a fact-filled bulletin entitled "The Big Squeeze" which is available from E-Z Pack Div., Hercules Galion Products, Inc., Galion, O.



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Meetings and Conventions

Rocky Mountain Sections, AWWA and FSIWA
Jackson, Wyo., Sept. 8-10

Wisconsin Section, AWWA
Milwaukee, Wis., Sept. 9-11

Georgia Section, FSIWA
Atlanta, Ga., Sept. 9-11

Institute of Traffic Engineers
New York, N. Y., Sept. 13-17

Kentucky-Tennessee Sections AWWA and FSIWA
Lexington, Ky., Sept. 14-16

New York Section, AWWA
Upper Saranac Lake, N. Y., Sept. 16-18

North Central Section, AWWA
Minneapolis, Minn., Sept. 16-18

American Public Works Assn.
Seattle, Wash., Sept. 20-23

New England Water Works Assn.
Lake Placid, N. Y., Sept. 20-23

Michigan Section, AWWA
Saginaw, Mich., Sept. 23-25

North Dakota Section, FSIWA
Grand Forks, N. Dak., Sept. 23-25

Missouri Sections AWWA and FSIWA
Kansas City, Mo., Sept. 27-29

Chesapeake Section, AWWA
Baltimore, Md., Oct. 7-9

Intermountain Section, AWWA
Pocatello, Idaho, Oct. 8-9

Federation of Sewage and Industrial Wastes Assns.
Dallas, Tex., Oct. 12-15

Iowa Section, AWWA
Des Moines, Iowa, Oct. 14-16

Alabama-Mississippi Section and Southwest Section, AWWA
New Orleans, La., Oct. 18-21

American Society of Civil Engineers
Washington, D. C., Oct. 18-23

American Public Health Assn.
Atlantic City, N. J., Oct. 19-23

New England Section, FSIWA
Providence, R. I., Oct. 21-22

Street Maintenance and Sanitation Officials of Ohio
Columbus, Ohio, Oct. 22-24

New Jersey Section, AWWA
Atlantic City, N. J., Oct. 22-24

National Highway Conference for County Engineers and Officials of ARBA
Minneapolis, Minn., Oct. 26-28

West Virginia Section, AWWA
Parkersburg, W. Va., Oct. 28-29

Ohio Section, AWWA
Dayton, Ohio, Oct. 28-30

American Road Builders' Assn.
Cincinnati, Ohio, Jan. 18-20, 1960

Sept. 1959

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. . . specifically designed to reduce wear caused by repeated opening and closing when used in such installations as pump suction or discharge lines. All working parts are heavily constructed from high-strength materials to assure long, dependable operation without maintenance. Suitable for vertical or horizontal use. Swing type, Swing type with Lever and Weight, and Swing type with Lever and Spring available.

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Bronze seat ring
Bronze disc ring or rubber faced disc
Flanged, screwed or hub ends
Working pressure: 175 p.s.i.
Test pressure: 300 p.s.i.

FLAP VALVES

. . . for use where flow is desired in one direction only and to the atmosphere; for example, a river levee installation. The area behind the levee would drain into the river only when the river was low and below the flap valve. A higher level of the river would seal the valve.

Iron body, fully bronze mounted
Bronze seat ring, disc ring and hinge pin
Flanged, hub or spigot frame
Sizes: 4" through 24"

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Flanged, hub or spigot frame
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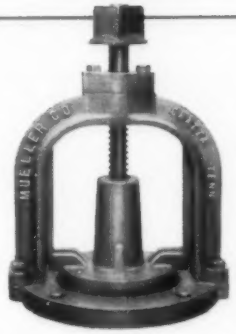
. . . usually used for draining tanks or reservoirs by mounting in floor. Non-rising stem or self-contained rising stem type available. Normally furnished with 2" square wrench nut but handwheel, extension stem or extension stem and floor stand may be specified.



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Rising stem sizes: 4" through 18"

VALVE OPERATING EQUIPMENT

A full line of extension stems, floor stands, bench stands, geared floor stands, chain and sprocket wheels, wrenches and other valve operating equipment and accessories are available for valve installations requiring operating mechanisms.

Write for complete information and specifications.

MUELLER CO.
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Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario.

To order these helpful booklets check the reply card opposite page 36.

NEW LISTINGS (Cont.)

Building a
Giant Water Line

157. Construction of a 14-ft. diameter steel water line in Pennsylvania is described in this 4-color, 4-page bulletin available from Bethlehem Steel Co., Bethlehem, Pa. Check the reply card.

Data Manual on
Swimming Pool Equipment

172. This manual on 3-cell horizontal sand pressure filters and swimming pool equipment contains installation data, selection charts and design notes and is available from Smith & Loveless, Inc., P. O. Box 8884, Kansas City 15, Mo. Check the reply card.

Expanded Line of
Plastic Dall Flow Tubes

174. An expanded line of Builders-Providence insert-type plastic dall flow tubes for primary flow metering is described in bulletin from Builders-Providence division of B-I-F Industries, Inc., Providence 1, R. I.

Davis Backhoe Has
Hydra-Slide Positioning

189. It is possible for one man to move the entire digging assembly along the frame to any of the five positions in less than five minutes. Full details from Massey-Ferguson Industrial Div., 1009 South West St., Wichita, Kans. Check the reply card.

Bell and Spigot Joint
Leaks Quickly Repaired

214. Broken water main can quickly be repaired when you have "Skinner-Seal" Bell Joint Clamps on hand. Leaky bell and spigot joints are made lastingly tight with Skinner-Seal Bell Joint Clamps. Get Skinner Catalog GW now—this handsome 48-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily.

Catalog on Equipment
For Ice and Snow Control

215. Information on Baker snowplows and Flink ice control spreaders is available from The Flink Co., Dept. 5613, Streator, Illinois. Fully covered are reversible and one-way plows with hydraulic power lifts to meet every specification and single or dual spinner type spreaders. For reference catalog #110 check the reply card.

Use The Reply Card

Incinerators for the
Disposal of Combustible Wastes

217. Bulletin 179 from the Morse Boulger Inc., New York 17, N. Y. describes fully the basic principles of incineration as to combustion, auxiliary burners, draft and control and elimination of fly ash. Specifications and design of incinerators and hopper doors are included.

Meters and Instruments
For Water Works

224. An attractively arranged 20-page booklet issued by Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

How to Select the Right
Paint For Every Maintenance Need

229. A paint index for the selection of the right paint for your maintenance needs is available from Tropical Paint Co., Cleveland 2, Ohio.

Modern Economical Tractors
and Tractor Units

231. Up-front operator position, Quadratorque operation and greater ground clearance are some of the features of the new Eimco tractors. Check the reply card or write The Eimco Corp., Tractor Loader Div., 634 South 4th West, Salt Lake City, Utah, for your literature.

The Rough and Ready Rotocycle
for Weed and Brush Cutting

233. This complete cutter line has units with cutting widths from 60 to 144 ins., tow-type and 3-point lift-type and fact-hitch and snap-coupler type cutters. Complete specifications from the Perry Co., Waco, Tex.

Vapor Jet
Steam Cleaner

237. Northeast steam cleaner will handle hundreds of cleaning applications with ease, speed and economy. Check the reply card or write Northeast Industries, Inc., Midland Park, N. J., for complete specifications.

Turnkey Sewage
Treatment Plant

239. Plants for smaller population areas that are furnished and installed on a turnkey basis are covered in literature from Municipal Service Company, 4625 Roanoke Parkway, Kansas city 12, Missouri. Check the reply card for your key to low cost sewage treatment.

BUILD BETTER SEWER LINES

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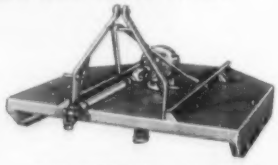

66" IMPERIAL converts to either tow type or lift type.

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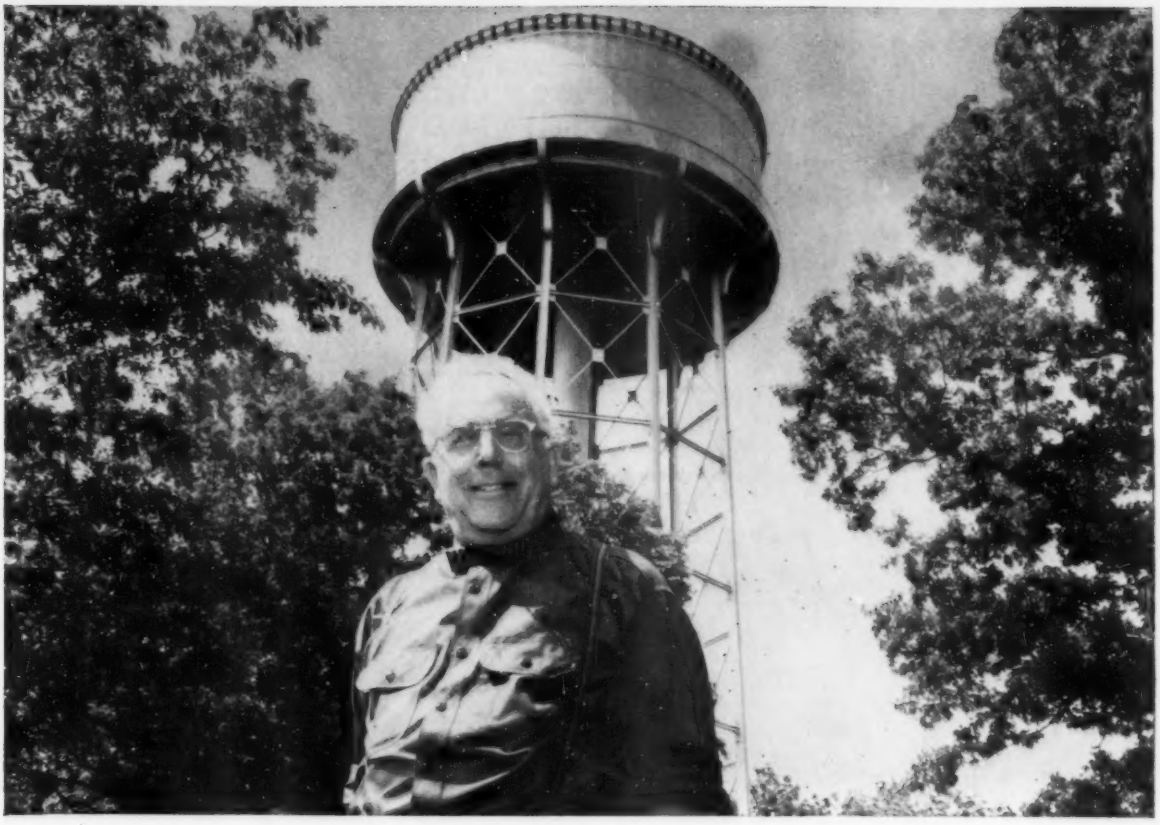

Jim Studley, Rockland, Mass. Water Department Supt. says:

"We really got our money's worth with Koppers' long-life coatings and top-notch service"

Rockland's 500,000 gallon water storage tank is an excellent example of the versatility of Bitumastic® coatings: it uses five different Bitumastic products to meet five different protective requirements.

As Mr. Studley puts it, "It's the inside you worry about: anyone can tell how outside coatings are standing up." To protect the storage tank interior, three coats of Bitumastic Tank Solution—specially compounded for potable water tanks—were used, with special protection of the tank roof by two coats of Bitumastic No. 50. The structure's exterior was coated with Bitugloss® Aluminum Paint for beauty and protection, with catwalks getting the extra protection of Bitumastic Black Solution.

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Please send me more information on the Bitumastic Method of corrosion prevention.

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To order these helpful booklets check the reply card opposite page 36.

WATER WORKS

Wherever Water Flows, Steel Pipes It Best

26. Complete data on the use of steel pipe for water supplies are available from Steel Plate Fabricators Association, 105 West Madison St., Chicago 2, Ill. Check the reply card today.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

Right Angle Gear Drive and Deep Well Turbine Pump

107. Applications, gear drive selection tables, pulley data, efficiencies and standard dimensions of Johnson right angle gear drives are covered in catalog from Johnson Gear & Mfg. Co., Ltd., Eighth and Parker Sts., Berkeley 10, Calif. Check the reply card.

Complete Line of Water Treatment Equipment

108. Eimco-Process development which combines coagulation and flocculation, sedimentation and sludge removal in a single unit is described in catalog from Process Engineers, Inc., Div. of the Eimco Corp., 420 Peninsular Ave., San Mateo, Calif. Check the reply card.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm units are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp, Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Now Every Municipality Can Own a Trencher

173. The low cost of the ARPS Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

Manual on Filter Bed Agitators

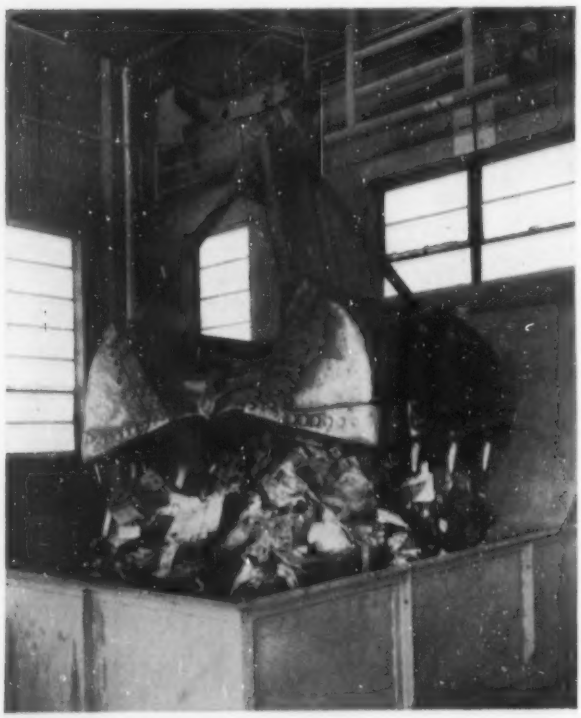
206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Manual on Coatings to Stop Rust

235. Primer type, short oil type, heat resistant, chemical resistant and floor coatings are a few of the items covered. Also complete data on Rust-Oleum products are included. Check the reply card or write Rust-Oleum Corp., Evanston, Ill., for this valuable manual.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.



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High performance, ruggedness, and low maintenance costs have earned a preferred status for Blaw-Knox Clamshell Buckets in incinerator operations all over the country. And Blaw-Knox backs up these specially designed buckets with practical design help too. Bulletin 2350-R-1 is made available to incinerator designers and operators to assist them in planning and selecting the proper type of Clamshell Bucket or Grapple best suited to individual operating conditions. Write for a copy today.

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Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

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CreZon Keeps Our Sign Budget Down

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The smooth, grainless CreZon surface is easier to paint. Paint goes on faster, stays on longer. And it's easier to saw and drill because it doesn't split or crack.

But that's not all! These light-weight signs are easier to install *and require less maintenance.* The tough, durable CreZon surface stays smooth and good-looking for years. Damage by vandals is less of a problem, too.

If you'd like to produce more—and better—signs for less money, I'd suggest you start using CreZon overlaid plywood in your sign shop.

Order CreZon from your regular plywood supplier under these brand names: Super Siding, G.P.X., Armorite, Duraply, Everside, Plyaloy, CreZon Overlaid Plywood.

CROWN ZELLERBACH CREZON SALES

In Canada address product inquiries to Crown Zellerbach Canada Limited, Vancouver, B. C.

To order these helpful booklets check the reply card opposite page 36.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Outline of Modern Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

Quick Review of Water Meters

316. A helpful condensed catalog which covers sizes and types of water meters for every kind of service is available from Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. Each type is illustrated and fully described; specifications and prices are included. Get Bulletin W-800 by checking the reply card.

Submersible Pumps for Water Supplies and Booster Systems

328. Selection tables, performance curves, construction details and the many features of Myers submersible pumps are covered in Catalog 140 available from The F. E. Myers & Bro. Co., 249 Orange St., Ashland, Ohio.

Manual on the Hersey Disc Water Meter

339. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-⅝"x¾"-¾" and 1". Check the reply card

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 18, Wisconsin.

Concrete Admixtures and Joint Sealers

346. Retarding and accelerating densifiers for concrete and mortar, coatings for exposed aggregate concrete, non meltable mastic waterstops and quicksetting products are covered in 8-page bulletin available from Sika Chemical Corp., 29-49 Gregory Ave., Passaic, N. J.

Use The Reply Card

Reference Bulletin Showing Treatment and Correction for Masonry Construction

357. Maintenance problems of masonry construction are covered in this 20-page bulletin from Standard Dry Wall Products Inc., New Eagle, Pa. Check the reply card for this complete and concise bulletin.

385-HP Engine For Standby Pumps and Generator Sets

372. International 385-hp compact heavy-duty 4-cycle, 6-cylinder engine is well illustrated in literature from International Construction Equipment, International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Check the reply card for full specifications.

Submersible Pumps for Municipal Water Supply

478. Submersible pumps from 3 through 125 hp in speeds of 3550 and 1750 rpm are described and illustrated in Bulletin B1200 available from Sumo Pumps, Inc., 23 Brown House Road, Stamford, Conn.

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois, or by circling the reply card.

Mueller Drilling, Tapping and Inserting Machine

696. The Mueller B-100 double pressure chamber tapping machine makes faster taps, assures pressure tight connections and can be used by hand or with power. Check the reply card or write Mueller Co., Decatur, Ill.

Catalog on Selecting Equipment For Water-and-Waste Treatment

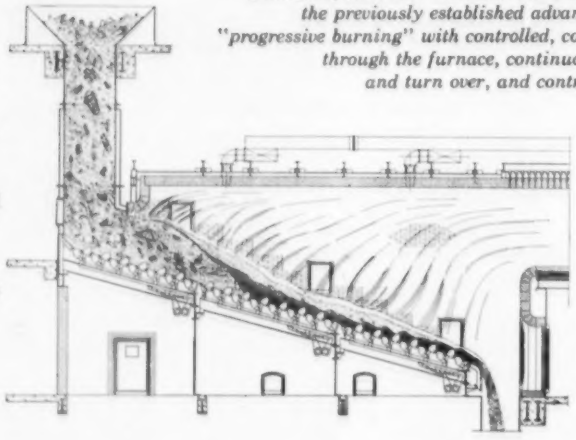
718. Cross-indexed for quick, easy reference to equipment, trade names and applications, this 32-page catalog covers all major equipment in the complete Infilco line. Write for Bulletin 80 to Infilco Inc., P. O. Box 5033, Tucson, Ariz., or check the reply card.

F&E Constant-Flo Incinerator Stoker

Companion Stoker—F&E Multi-Cell Incinerator Stoker

In addition to the F&E Multi-Cell Incinerator Stoker, the Flynn and Emrich Company now offers for those municipalities desiring the continuous flow type of operation, the F&E Constant-Flo Incinerator Stoker, using the latest application of our tried and proven F&E stoker principles. Write today for brochure or plans.

Through automatic operation, electronically controlled, the F&E Constant-Flo Incinerator Stoker combines the previously established advantages of F&E "progressive burning" with controlled, constant flow of material through the furnace, continuous agitation, break up and turn over, and controlled residue disposal.



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GRAY-IGAS
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SERVICE CLAMPS

fast, permanent connections to any main

Entire body heavily galvanized for maximum resistance to corrosion.

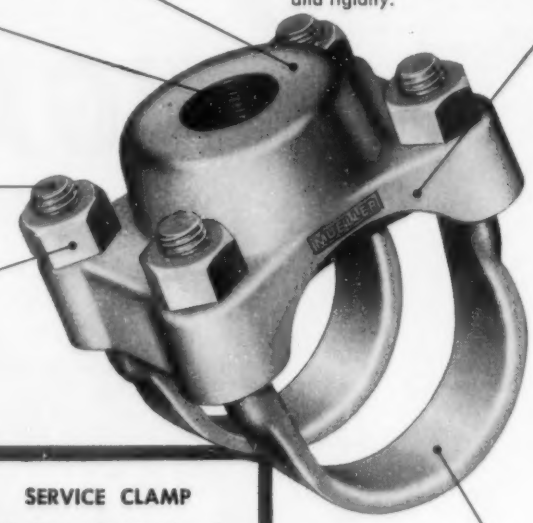
Tough, malleable iron body accurately fits contour of pipe and gives maximum strength and rigidity.

Full length threads, precision machined in thick body boss, assure solid, leak-proof connections.

Unusually large cross sectional area provides maximum strength during installation. Even the smallest clamp has a ⅜" diameter strap because this is the smallest size bolt that cannot be broken by a normal individual in normal use.

Rolled steel, cadmium plated nuts accurately machined to give solid, permanent connection without re-tightening. National Standard threads give maximum strength by assuring precise fit.

Neoprene gasket, recessed into body, is not affected by water and gives positive, easily-made seal. Regularly furnished, neoprene gasket is cemented in place for ease of installation. Lead ring gasket also available.



SERVICE CLAMP

Mueller or Iron Pipe thread tapping.

Tapping sizes from ½" through 2".

Pipe sizes from 1" through 12".

Single or double strap type.

Heavy cadmium plating on strap and threads gives maximum resistance to corrosion.

Forged steel straps, accurately curved to fit pipe, are as wide and flat as practicable to give maximum bearing and greater stability.

Flattened strap gives large contact area—increasing life of clamp by reducing effect of corrosion.

All Mueller Service Clamps now packed in labeled, corrugated cartons for ease in handling, shipping and storing.

These features are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product manufactured for the water industry. Write for complete information.

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Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

Modern, Welded Constructed Elevated Steel Tanks

382. Revised edition of Horton ellipsoidal elevated steel tanks of welded construction is available from Chicago Bridge & Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. The catalog is well illustrated and contains a table of standard tank dimensions for capacities ranging from 40,000 to 500,000 gals.

Residual Chlorine Recorders For Water Plants and Swimming Pools

508. An instrument for measuring residual chlorine amperometrically in a continuous sample and recording the reading in parts per million on a 24 hour circular chart is described fully in literature available from Wallace & Tiernan Inc., Box 178, Newark, N. J.

Bitumastic For Lasting Protection Against Corrosion

570. Bitumastic protective coatings prevent corrosion of metal and deterioration of concrete and masonry and are fully covered in catalog from Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa.

Streamlined and Modernized Fire Hydrants

607. Models, dimensions and advantages of the Eddy fire hydrant are covered in bulletin from the Eddy Valve Co., Waterford, N. Y. Check the reply card for complete details.

●

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Bare Pavement Maintenance With Sterling Rock Salt

84. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Scranton, Pa.

Snow Plows For Every Need

294. Frink snow plows are designed to meet snow removal needs at airports, parking lots and streets and highways. They consist of four basic types with models to fit trucks 1½ to 12 tons. For complete data write Frink Sno-Plows, Inc., Clayton, N. Y., or check the reply card.

Winter Road Maintenance With Calcium Chloride

386. This bulletin contains data on why calcium chloride mixtures work better, how and in what percentages to store, mixing methods and recommendations for various storm conditions. Check the reply card or write Columbia-Southern Chemical Corp., One Gateway Center, Pittsburgh 22, Pa., for your copy.

Sand, Chip and Calcium Chloride Spreader For Ice Control

429. Complete specifications, performance records and prices on the Fox sand spreader are covered in literature from Fox River Tractor Co., Dept. R3, P. O. Box 469, Appleton, Wisc. Spreader can be attached or removed from most any dump truck in 15 minutes and can be operated from 5 to 40 miles per hour. Check the reply card.

Rock Salt For Ice and Snow Removal

534. Application rates and procedures of using Morton rock salt for ice and snow control are covered in catalog from Morton Salt Co., 110 No. Wacker Drive, Chicago 6, Ill. Check the reply card for Catalog F-35.

"Brush Disposal in ⅓ the time" with FITCHBURG CHIPPERS

Martin J. Kelly, President, Martin J. Kelly, Inc., Tree Expert, Cheshire, Conn. More than 28 years in the tree care business.

FITCHBURG CHIPPERS BELONGING TO MARTIN J. KELLY, INC., Cheshire, Conn., are well known along Connecticut roadways.

Painted bright yellow, and carrying a flashing red light, Kelly's three Fitchburg Chippers are in constant use with a 3 to 5 man crew doing custom line clearance work for utilities and other concerns.

Mr. Kelly has this to say about his Fitchburg Chipper fleet:

"We are operating three of your Fitchburg Chippers and find that the chipping of brush is done in one-third of the time that it would take to pile and burn the brush. It also eliminates the fire hazard of burning and the necessity of covering the burned brush.

The performance of these Chippers is very satisfactory and have given us no trouble.

We are writing this note to give you an idea of our experience and to let you know how we appreciate your equipment."

Before you buy chipping equipment for your line clearance operation, get full specifications and compare. Remember, Fitchburg Chippers and *only Fitchburg Chippers* have the patented spring-activated feed plate that provides extra safety in operation and assures ease in chipping all wood sizes to the machine's rated capacity.

Only Fitchburg Chippers have the hinged feed apron that can be closed when the Chipper is not in operation. *Only Fitchburg Chippers* give you a written ONE YEAR GUARANTEE. So get all the facts before you buy.

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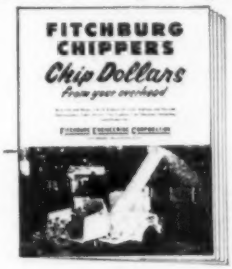
"Chip Dollars From Your Overhead"

20 pages. Complete with cutaway color drawings of Fitchburg Chipper in action. Specifications, etc. Write for your copy.



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Fitchburg, Massachusetts, Dept. PW-99

Send me free copy of "Chip Dollars From Your Overhead."

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To order these helpful booklets check the reply card opposite page 36.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

30. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Manual on Instrument Accessories and Supplies

96. The 60-page loose-leaf book, Catalog 500, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies. It is divided into 5 sections: Mechanical; pneumatic; electric-electronic, general, and tools and service. Check the reply card or write The Foxboro Co., Foxboro, Mass., for your copy.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Buckets and Grapples For Incinerator Service

110. Bulletin provides comprehensive information on the 5 sizes of 2-line, lever arm, clamshell-type buckets; standard 2-line, tine-type grapples; equalizer arrangements and certain incinerator buckets for single drum hoists. Check the reply card or write Blaw-Knox Co., 300 Sixth Ave., Pittsburgh, Pa., today.

Handbook for Engineers on Design and Construction of Culverts

121. Metal pipe specifications, highway, municipal and airport drainage facts, selecting a drainage structure, designing waterway area, designing for structural strength and headwalls and inlets are sections covered in this handbook. Check the reply card or write Republic Steel Corp., Culvert Div., 2318 — 13th St., N.E., Canton 5, Ohio.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Flush Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holliday and Saratoga Sts., Baltimore 2, Md.

Heavy Duty Air Cooled Engines For Many Uses

223. Power and weight specifications, dimensions and uses are fully covered in literature issued by Wisconsin Motors Corp., Milwaukee 46, Wis., on their air-cooled engines. Also available is a service map and a list of their distributors and approved service stations.

Bulletin on Waste Treatment Equipment

289. Equipment covered in Bulletin No. 315-11 includes bar screens, grinders, collectors, skimmers, separators and flocculation equipment. Check the reply card or write Chain Belt Co., Milwaukee 1, Wisc., for this data.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

ACCURATE GRAPHIC AND VISUAL REGISTRATION

of liquid flow with

STEVENS

RECORDER TYPE B-FT

Recording, indicating and totalizing meter for measuring sewage or other flows over Parshall flumes and weirs. This instrument has interchangeable flow cams and flow conversion gears . . . an important factor to consider for sewage treatment plants in rapidly growing communities. With a simple change of cams and gears the Type B-FT Recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily time scale, or vice versa, is accomplished by merely repositioning one gear — no new parts to buy.

This recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out of doors directly over the float well. Request BULLETIN 25 for complete details.

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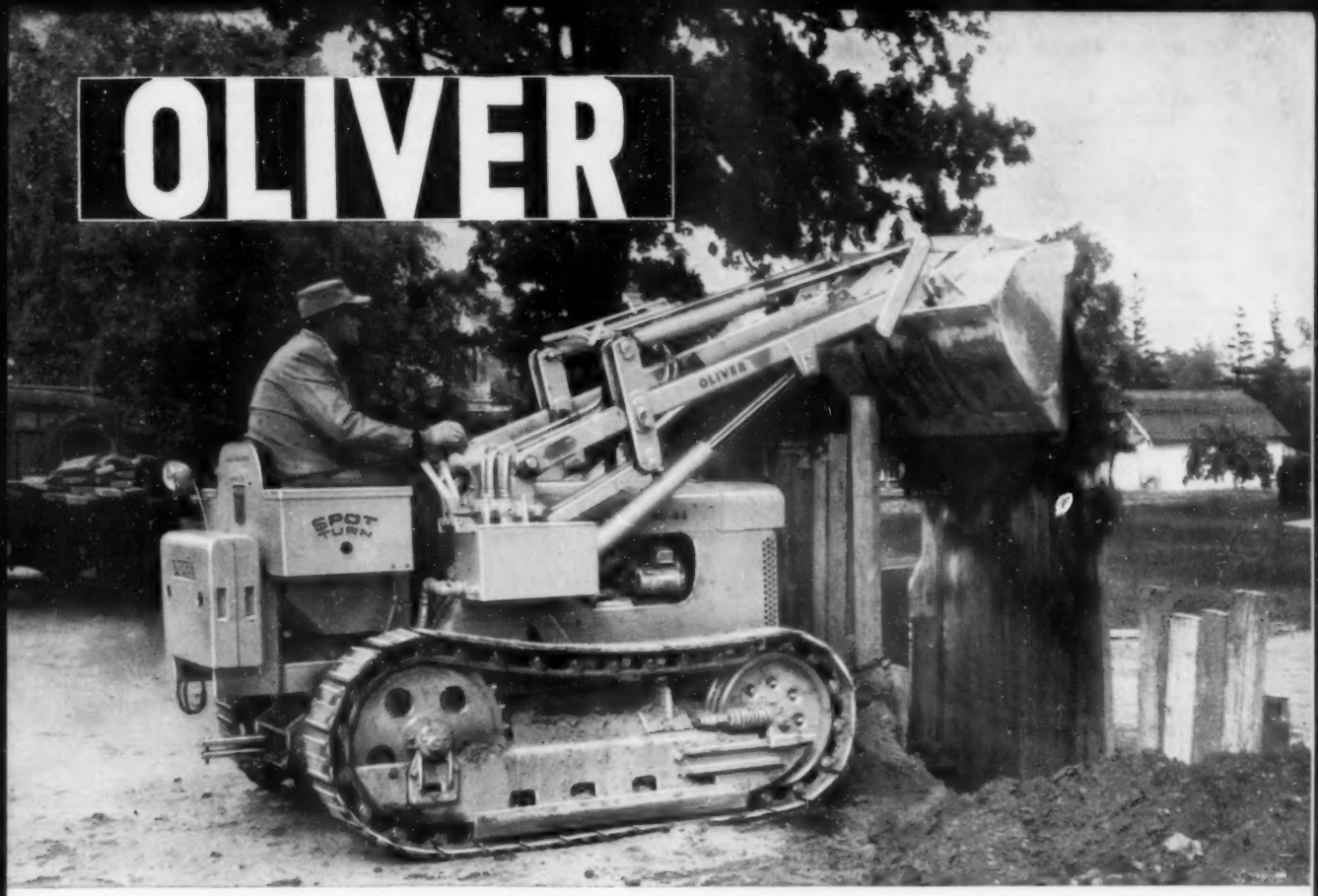

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For an immediate step-up in work *and* work range, the Oliver OC-46 delivers the goods!

It's factory-built specifically as an integrated digging-loading machine with heavy-duty capabilities—a perfect match between tractor and loader. You get fast, full bucketloads quickly and easily—and hustle them through the cycle in jig time. Add Oliver "Spot-Turn" steering—diesel or gas power—and you have the machine that's built for more jobs and lower job costs.

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WORK-TEST IT! See what the OC-46 will do on your own work. Sample its production and you'll agree: it is today's best tractor buy! Call your Oliver distributor.

Have a look at this new tractor catalog on the OC-4 "Spot-Turn." It's filled with application pictures and data...shows many different work-speeding equipment changes! It's important reading for tractor users. Mail the handy coupon today!

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Please send me your new 16-page, color catalog on the OC-4 tractor. T24-9

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(Please print)

Company or Department.....

Address.....

City.....Zone.....State.....

To order these helpful booklets check the reply card opposite page 36.

Plunger Pumps of Heavy Duty Design

309. Plunger pumps, simplex, duplex, and triplex of heavy duty design including dual valves and improved reduction gear mechanisms are covered in bulletin KSP-3 which gives selection charts and application data and is available from Komline-Sanderson Engineering Corp., Peapack, N. J., or by checking the reply card.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, and end suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., 636 Loucks St., Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

Electric Submersible Contractor Pumps

376. Capacity curves, specifications, accessories and list prices of Flygt electric submersible contractor pumps are covered in literature from Stanco Mfg. & Sales Inc., Construction Equipment, 1666 Ninth St., Santa Monica, Calif. Check the reply card.

Directly Readable Flow Charts for Measuring Sewage

380. Recorder gives graphic records of liquid flow directly readable in mgd or gpm over various sizes of Parshall flumes. Check the reply card or write, Leupold & Stevens Instruments, Inc., 4445 N. E. Glesan St., Portland 13, Ore., for Bulletin 24.

Grit Collecting And Grit Washing Equipment

580. This 28-page book on grit collecting and grit washing equipment is profusely illustrated and contains data on 7 types of grit collectors, 2 grit washers and the Tritor screen. Detailed drawings and specifications are included to assist the engineer in the preparation of drawings. For your copy of Book 2571 check the reply card or write the Link-Belt Co., Colmar, Penn.

Fibre Pipe For Sewer Lines and Septic Tank Connections

232. Bermico bituminized fibre pipe is lightweight, rootproof and easy-to-install. Check the reply card or write Brown Co., 150 Causeway St., Boston 14 Mass., for full details.

How to Choose the Right Self-Priming Centrifugal Pump

427. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Valuable Information on Incinerator Stokers

505. The Combustion Engineering stoker is described fully in Catalog No. IS-1 which is available from Combustion Engineering, Inc., Combustion Engineering Bldg., 1132 W. Blackhalk St., Chicago 22, Ill. Schematic drawings of the units, advantages of incineration, firing methods, design and performance are sections covered. Check the reply card today.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Torque-Flow Sewage Pump For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemco torque-flow sewage pump and covers typical installation set-ups. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

4-D Wrought Iron for Building Drainage Systems

551. A comprehensive 64-page catalog on piping for soil, waste, vent and downspout applications is available from A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa. Check the reply card for corrosive conditions, typical installation, performance tables and piping economy.

Weinman Horizontal Non-Clog Centrifugal Pumps

579. Non-clog pumps for sewage and sludge in municipal plants are covered in literature from the Weinman Pump Mfg. Co., 290 Spruce St., Columbus 8, O. Specifications and dimensions are included.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized SeweRodeR. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif.

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PARK, PICNIC, PLAYGROUND AND SWIMMING POOL EQUIPMENT
Since 1911 the finest equipment built, backed by lifetime guarantee against defective materials and construction . . . specified by leading recreational authorities for almost half a century.
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PLAYGROUND DEVICE CO.
ANDERSON, INDIANA, U.S.A.
WORLD'S LARGEST MANUFACTURERS OF FINE PARK, PICNIC, PLAYGROUND, SWIMMING POOL AND DRESSING ROOM EQUIPMENT

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Wherever there may be a tornado, earthquake, flood or other disaster the saving of many lives and millions in property damage can be accomplished by fast restoration of power.

Within SECONDS of power failure Synchro-Start Controls activate any stand-by engine to produce emergency power for vital utilities such as, fire protection, communications, light and refrigeration. When main line power is restored the controls quickly transfer the load.

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One of the new low-cost Barber-Greene Batch Plants in operation. Available in both 1000 and 1500 lb. sizes, these new plants include many years-ahead features.

two new low-cost Barber-Greene Batch Plants

with advanced big-plant features

Write for information on these two new profit-building batch plants.

Many advanced features in new low-cost batch plants

Incorporating job-proved advantages of the famous Barber-Greene Batch-Omatics, these two plants also have many new features, including:

- **New Batchometer Asphalt Metering System** automatically meters preset quantity of asphalt to pugmill for each batch.
- **Dyna-Mix Pugmill** for faster mixing, more uniform coating . . . long life, easy maintenance.
- **Quick, Easy Erection** with three-unit design: screen and bin section; weigh-hopper and pugmill section; base section. Tapered pins guide sections into place . . . automatically align all bolt holes.
- **3⅓ Deck Vibrating Screen,** with 40 sq. ft. of area, gives top capacity for each plant and for the full range of asphalt mixes . . . integral part of bin section for easier erection. Four bins are standard—not extra.
- **Optional Hydraulic Controls** for easier operation . . . relieve operator of manual exertion; easily converted in the field.
- **Hydraulically Operated Pugmill Discharge Gate** provides instant discharge of mix . . . eliminates segregation. No time wasted between batches.
- **Other Advantages Include:** easier maintenance; complete line of accessories, including fines system; combined overflow chutes; scavenger dust system.

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CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

To order these helpful booklets check the reply card opposite page 36.

CONSTRUCTION EQUIPMENT AND MATERIALS

Capacity, Weight and Power You Want in a Compressor

148. Bulletin 2307 available from Ingersoll Rand, 11 Broadway, New York 4, N. Y., gives complete specifications on the Ingersoll-Rand 85 cfm rotary compressor. Check the reply card for data on this ideal air power plant for hundreds of municipal maintenance jobs.

1½ Cu. Yd. Tractor Shovel for Standout Performance

208. The Trojan 124 has 10,000 lb. rated lifting capacity, power shift transmission and 40° bucket tip at carry position. For literature write to Trojan Div., The Yale & Towne Mfg. Co., Batavia, New York.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

Drilling Machine For Concrete

221. The Truco diamond drilling machine is described in literature available from Truco Masonry Drilling Div., Wheel Trueing Tool Co., 15-3200 W. Davison Ave., Detroit 38, Mich. Unit will cut reinforced or plain concrete.

Austin-Western Construction Equipment Catalog

260. Power graders, street sweepers, road rollers, crushing and screening plants and hydraulic cranes are covered in catalog from Austin-Western, Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Aurora, Ill.

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Manual on the Use and Application of Compactors

261. A Manual covering the various types of compaction equipment in use today and including rollers and vibratory compactors is available from The Galion Iron Works & Mfg. Co., Galion, O. Check the reply card for details on the problems encountered in the efficient compaction of various materials, and the correct use of communication equipment available.

Why and How To Use Pneumatic Tired Rollers

290. The why and how of pneumatic tired rollers on base and surface courses, sealing completed fills, surface treatments, floated surfaces, hot and cold asphalts and stabilized soils are covered in Bulletin 10 from Tampo Mfg. Co., San Antonio, Tex. For information on operating conditions and compaction charts check the reply card.

Allis-Chalmers Crawler Tractors and Motor Scrapers

306. Two catalogs offered by the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wisc., give engineering features and operating advantages of the TS-260 motor scraper and the HD-6 diesel powered crawler tractor. Check the reply card for specifications.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 155 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

Principles of "BatchOmatic" Plants Explained

527. The unique principles of simultaneous and fully automatic aggregate and bitumen measuring followed on Barber-Greene's 2,000, 4,000 and 6,000 lb. "BatchOmatic" bituminous batch plants are explained with cut away drawings, charts and other illustrations in a 3-color bulletin offered by Barber-Greene Co., Aurora, Ill. Check the reply card.

A Completely Hydraulic Ladder

610. This completely hydraulic ladder is described in a new catalog published by J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestals, throttle control and ladder construction are included.

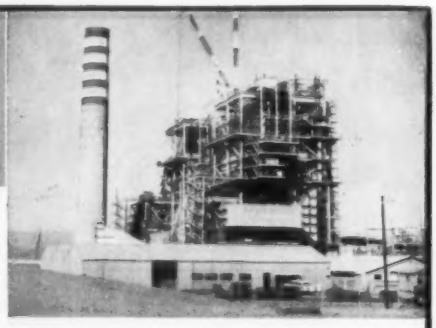
Slide Rule PS1 Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

(More listings on page 54)

FOR UTILITIES and GOVERNMENT AGENCIES

DE-WATERING PROBLEMS LICKED with FLYGT Submersible Electric Pumps



Public Utilities and Government Agencies throughout the world find FLYGT SUBMERSIBLE ELECTRIC PUMPS tops in performance on any de-watering problem. Public Works users like FLYGT foolproof features, the advantage that the pumps work in any position, and the fact that they do not clog up. They can take a lot of solid stuff like mud and sand without hurting them in any way. The rubberized pump casings and hard chrome alloy impellers combine to make FLYGT PUMPS rugged equipment which works 24 hours a day with little or no attention. Low in initial cost . . . low in operating expense, FLYGT PUMPS will save you money.

FLYGT SUBMERSIBLE ELECTRIC PUMPS range in size from 1½"-85 GPM capacity to 8"-3000 GPM capacity. Head capacities range up to 210 feet. Higher heads obtainable with FLYGT PUMPS in tandem. Weights range from 70 to 1200 pounds. Write for complete specifications.

Near Los Angeles, California, the immense Steam Generating Plant illustrated above produces more electricity than Hoover Dam, and when completed it will be one of the major sources of electric power in the entire West. This plant uses two FLYGT models B-80 and one B-38L for a variety of around-the-clock de-watering applications. Operating at the bottoms of sumps and excavations, the FLYGT PUMPS keep strategic areas free of salt-water intrusion and seepage from storm water run off. The FLYGTs often pump a high proportion of solids, and have proven resistant to salt water.

CHECK THESE FLYGT FEATURES

- Electric, fully submersible, fully portable.
- Instant pumping — no priming, no installation.
- Runs dry without damage, resistant to salt water.
- Takes a high proportion of solids, frost and fire-proof.
- Practically no maintenance or supervision.
- Operates unattended, quick and easy to service.

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WEST OF THE MISSISSIPPI: Stanco MFGR. & SALES INC. 1666 Ninth St. (Corner of Olympic & Ninth) Santa Monica, California.

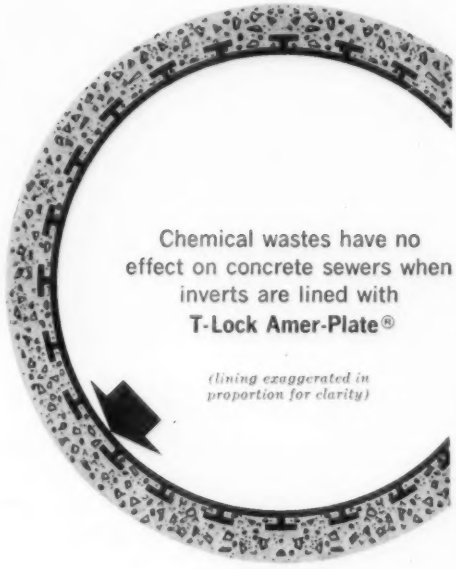
EAST OF THE MISSISSIPPI: STENBERG MANUFACTURING CORPORATION Hoosick Falls, N.Y.

How to prevent

Chemical Disintegration of Concrete Sewers

T-Lock Amer-Plate is a high polymer PVC sheet, easily cast into pipes, tunnels and structures to form a partial or complete 360° protective lining. Used in inverts, it permanently protects concrete from corrosive chemical effluents. In arch areas, it positively stops oxidized H_2S corrosion. T-Lock is also highly abrasion resistant; impartial tests show that it abrades at only 1/70th the rate of concrete.

The fact that T-Lock ends erosion and corrosion problems in industrial and municipal sewer systems is attested to by more than five million square feet now in use.


Chemical wastes have no effect on concrete sewers when inverts are lined with
T-Lock Amer-Plate®
(lining exaggerated in proportion for clarity)

WRITE FOR THIS FREE DATA

Any of the following printed pieces may be obtained without obligation by writing to Amercoat Corporation at the address shown below. Perhaps the information contained will prove helpful to you when designing your next sewer.

BROCHURE: T-Lock Amer-Plate, locked-in protective lining for concrete pipe, tunnels and structures.

LIST: Sewers in which T-Lock Amer-Plate has been installed, including names of purchasing bodies, locations, dimensions and dates.

REPRINT R-6: Wichita's new sewer is plastic lined to protect concrete from sulfide gas (Kansas Construction Magazine).

REPRINT R-7: How T-Lock was applied to a cast-in-place concrete sewer tunnel (Engineering News-Record).

REPRINT R-10: How City of Los Angeles protects new sewer against corrosion (Water & Sewage Works and Public Works).

REPRINT R-15: Try these tricks for faster lining of sewer tunnels (Construction Methods & Equipment).

Applicators strategically located throughout U. S. and Canada

Amercoat® CORPORATION

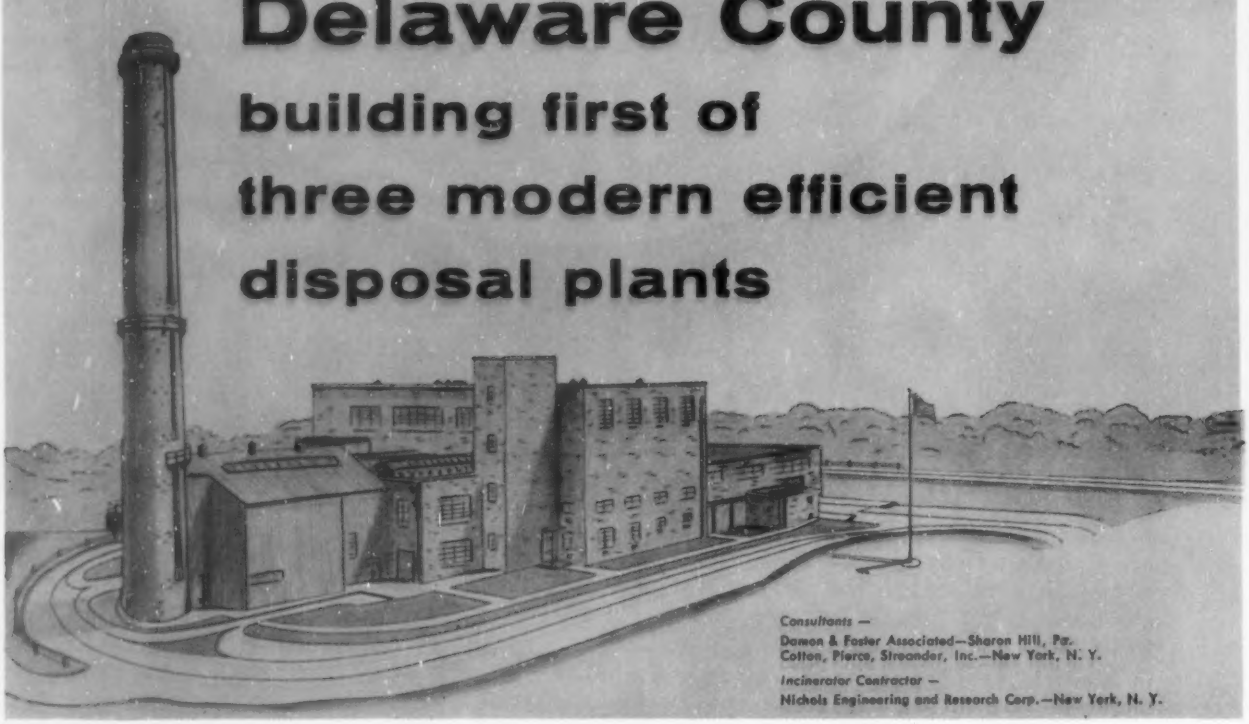
Dept. BI • 4809 Firestone Boulevard
South Gate, California

• 921 Pitner Avenue • Evanston, Illinois
• 360 Carnegie Avenue • Kenilworth, New Jersey
• 2404 Dennis Street • Jacksonville, Florida
• 6530 Supply Row • Houston, Texas

118 A

a BETTER answer to municipal REFUSE problems

Delaware County
building first of three modern efficient disposal plants



Consultants —
Damon & Foster Associated—Sharon Hill, Pa.
Cotton, Pierce, Stroander, Inc.—New York, N. Y.
Incinerator Contractor —
Nichols Engineering and Research Corp.—New York, N. Y.

Taking advantage of the economies inherent in wide-scale cooperative planning, Delaware County, Pa., is effectively solving a refuse disposal problem by developing a highly efficient 3-plant disposal system, each plant having a capacity of 500 tons per day. The first of these plants, now under construction, will have all the important advantages of continuous operation – through the use of C-E Incinerator Stokers. Two 250-ton capacity C-E Stoker Systems have recently been ordered. Each is equipped with an inclined "drying" stoker and a horizontal "burning" stoker, both of the traveling grate type as shown on the opposite page.

Delaware County's choice of "continuous processing" over the widely used "batch processing" is a matter of sound economics, since every C-E Stoker System installed to date has service-proved its labor-saving and reliability attributes. Delaware County's next door neighbor, the city of Philadelphia, has selected the C-E System for its Northwest Incinerator Plant after intensive study of the subject. Four large plants in the City of New York use the C-E Stoker System with outstanding success.

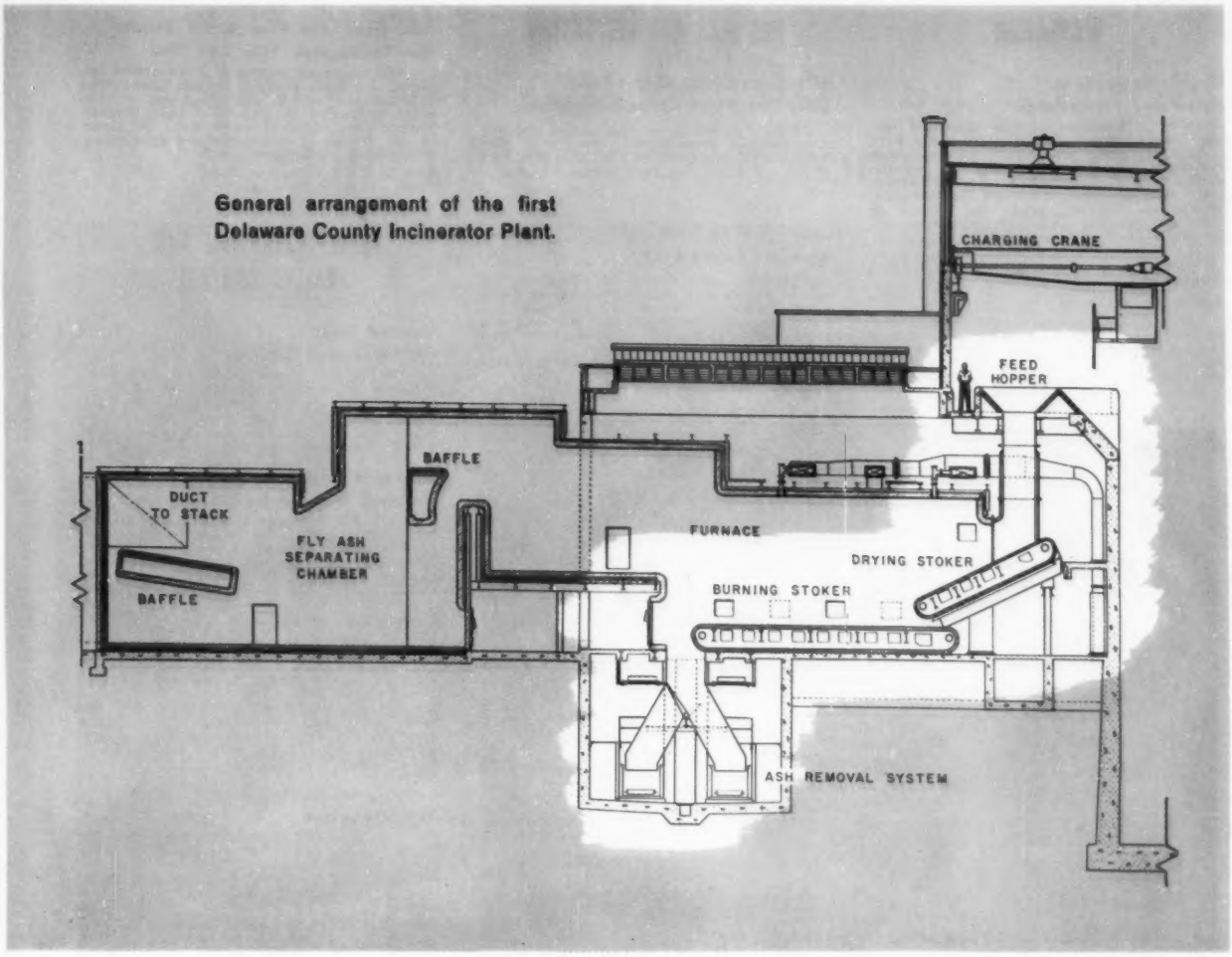
Decontaminated refuse, as it is discharged from the C-E Incinerator Stoker, provides a sanitary, inoffensive fill for reclamation of waste land.

In some instances it may be found desirable to combine the refuse disposal plant with a C-E Raymond Flash Dryer System for sewage sludge disposal. Heat generated from the burning of refuse becomes a convenient cost-free medium for drying sewage sludge prior to its incineration, or recovery as a soil conditioning fertilizer.

The C-E Incinerator Stoker is designed to handle all types of combustible refuse in quantities ranging upward from 50 tons per 24-hour day.

For further information, please contact the Combustion office in your city, or write directly to Combustion Engineering, Inc., 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL-BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;



General arrangement of the first Delaware County Incinerator Plant.

ADVANTAGES OF C-E STOKER SYSTEM

- Large hopper and chute provide sealed, continuous supply of refuse.
- Feed of refuse is unobstructed, nonclogging.
- Advance of fuel bed from front to rear is positive, continuous.
- Supply of air to fuel-bed is zone-controlled.
- Residue is discharged continuously from grate surface.
- Operation is easy — no heavy stoking or cleaning of fires.
- Chrome cast iron — most suitable material — is used for grate surface.
- Wide keys over driving chains prevent fouling.
- Grate elements are easily replaceable.
- Steel driving chains take all tension.
- Take-up mechanism is easily accessible at front.
- Maximum availability is assured.
- Stokers are applicable to largest incinerators.
- Less labor is required than with any other burning method.

COMBUSTION ENGINEERING

C-232

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

CANADA: Combustion Engineering-Superheater Ltd.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

To order these helpful booklets check the reply card opposite page 36.

RECREATION

How to Equip Your Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, park picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.

Rubberized Playground Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the reply card or write to U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y.

BUSINESS ADMINISTRATION

If You are Considering a Bond Issue Check with Chase Manhattan

236. For details on bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 40 Wall St., New York 15, N. Y. Check the reply card.

Monthly Time and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterpillar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply card for your copy.

Patch
ROADS THE LOW COST WAY
Temperature Easily Controlled
Easy to Transport
Saves Money on Patchwork
STANDARD STEEL TAR-KETTLES
PATCH AND MOVE ON IN MINUTES AND SECONDS
With this Standard Steel Model "S" Kettle, "cold spots" or "burnt materials" are eliminated. You get uniformity of heat throughout the entire mass of material. Steady temperature at the correct level is maintained all day long. Easily transported — equipped with special safety features — it's a fast worker. With a motor spray attachment, it is even more efficient for road maintenance. Standard Steel also offers a complete line of crack filling pots, shoulder rollers and other road maintenance equipment.
WRITE FOR CATALOG AND PRICES
OTHER PRODUCTS OF STANDARD STEEL
Asphalt Pressure Distributors, Maintenance Distributors, Patch Rollers, Supply Tanks, Tool Heaters, Asphalt Tools, Street Flushers, Construction Brooms.
Built to the Highest Standard
Standard Steel Works, Inc. NORTH KANSAS CITY, MO.

How Good Are Your Truck Drivers? The Tachograph Will Tell You

682. Accurate records of truck engine operation are made available by the Tachograph. Find out how savings and safety can be promoted by getting Bulletin SU-3 from Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo. Details of construction and descriptions of operation are included.

•

STREET LIGHTING AND TRAFFIC CONTROL

Plywood Signs For Expressway Signing

149. Crezon overlaid plywood signs will withstand the worst weather and will not check, split or bend or tear loose from the pole. Check the reply card or write Crown Zellerbach, San Francisco 19, Calif., for complete data on this signing material.

Damaged Barricades Can Be Repaired With PM Barricade Kits

163. PM barricade kits provide a flexible replacement system for damaged barricades. Check the reply card or write Pacific Mercury, 14052 Burbank Blvd., Van Nuys, Calif., for details on PM transistor neon or incandescent flasher warning lights.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Catalog on Tractor-Driven Tailgate Spreader

182. Highway Equipment spreader spreads in the echelon pattern for ice control and the blanket pattern for seal coating. For literature write Highway Equipment Co., Dept. H41 616D Ave. N. W., Cedar Rapids, Iowa.

New Reflectorized Sign Faces Refurbish Old Traffic Signs

292. Get complete details on new "Ez-On" traffic sign faces ready for immediate shipment. Reflectorized faces cost about one half as much as new signs and are easily attached to existing traffic signs. Grace Sign & Mfg. Co., St. Louis 18, Mo.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans., for your copy.

Monotube Poles for Highway Lighting and Signing

432. Highway pole designs, in both steel and aluminum, as well as various overhead sign mounting arrangements are illustrated in Catalog LS-23 available from The Union Metal Mfg. Co., Canton 5, Ohio. Check the reply card for base and bracket details and other specifications.

Practical Outdoor Lighting

489. P & K luminaires and standards for outdoor lighting provide good lighting and complement the architecture and design. Check the reply card or write Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., for models and types.

Aluminum for Complete Line of Signs and Sign Blanks

675. Valuable information on aluminum's advantages, features and economies, plus details on application of all sign message materials are covered in the aluminum sign bulletin from Kaiser Aluminum & Chemical Sales, Inc., Dept. MU-936, 919 N. Michigan Ave., Chicago 11, Ill. Check the reply card today.

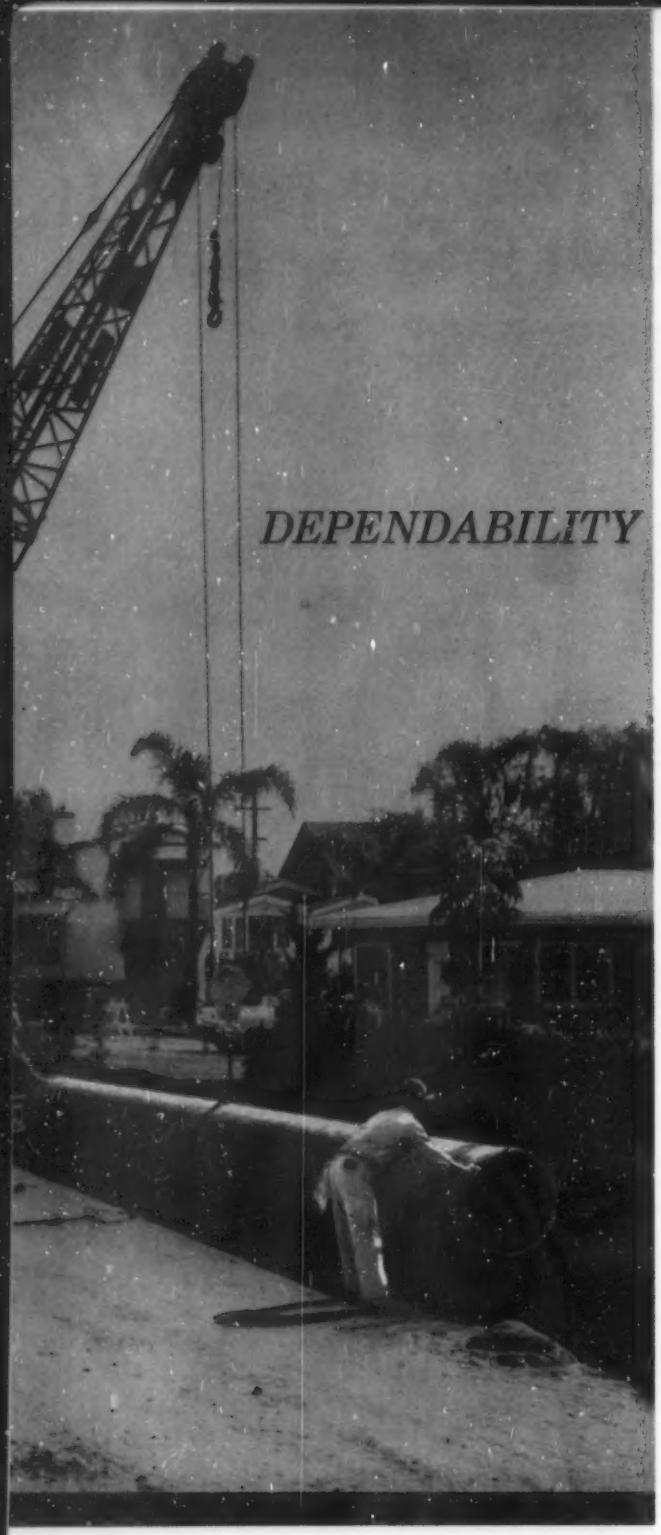
The steeper your hills...

the wiser you are to use straight Sterling Rock Salt for ice control

Sand and cinders just don't melt snow—have no effect on ice, sleet or freezing rain! That's why it's especially important to use straight Sterling Rock Salt on your hills. Sterling Rock Salt has melting power: to give you bare pavements, the *only* safe pavements during winter storms. For hills, it's sound practice to double the quantity of Sterling Rock Salt normally applied to flat stretches of road. This provides the extra traction and extra melting power needed.

International Salt Co., Scranton, Pa. • Baltimore • Boston Buffalo • Chicago • Cincinnati • Cleveland • Detroit • Newark New York City • Phila. • Pittsburgh • Richmond • St. Louis

STERLING "AUGER-ACTION" ROCK SALT
INTERNATIONAL SALT COMPANY, INC.



AMERICAN CONCRETE CYLINDER PIPE *provides...*

DEPENDABILITY with ECONOMY

This pretensioned concrete cylinder pipe embodies all of the qualities and characteristics sought by water works engineers for permanent water supply and transmission lines—strength, sustained high carrying capacity; trouble free service and unusually long life. Its competitive initial cost has made it possible for hundreds of water works agencies throughout the West to obtain these desired qualities for pipelines with pressures generally ranging from 100 psi upward, and requiring diameters of 10" through 60" (or in many cases larger, where specific project conditions permit). When you select pressure pipe for your permanent water "growth lines," be sure to investigate American Concrete Cylinder Pipe, a superior product with an outstanding record of acceptance.

A. The steel cylinder provides a positive water seal or membrane as well as part of the total steel area required for internal stresses.

B. The smooth centrifugally applied mortar lining of a nominal ¾" thickness provides positive internal protection, sustained hydraulic capacity, and, **imparts rigidity and strength through "arching effect."**

C. Steel reinforcement rods, which together with the steel cylinder provide the total cross-sectional steel area required for the operating pressure specified, are wound under controlled tension and accurate spacing around the concrete lined cylinder, placing it under moderate compression.

D. In conjunction with the steel rod reinforcement along the entire surface of the cylinder, the application of a dense concrete coating produces, in effect, a **reinforced jacket** which affords additional structural strength as well as positive exterior protection.

The 32-foot long pipe sections are easily installed with standard equipment using a single cable sling. In addition to providing a watertight seal, the rubber gasketed joint facilitates ease and economy of installation, and eliminates the need for caulking or field welding.

American PIPE AND CONSTRUCTION CO.

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SAN DIEGO: P. O. Box 13 — CYpress 6-6166
PORTLAND: 518 N. E. Columbia Blvd.— BUtler 5-2531
ALBUQUERQUE: P. O. Box 1782 — CHapel 7-0486
PHOENIX: American Concrete Pipe Co. (Subsidiary)
P.O. Box 12127 — Alpine 2-7566

CONCRETE PIPE FOR MAIN WATER SUPPLY LINES. STORM AND SANITARY SEWERS. SUBAQUEOUS LINES

To order these helpful booklets check the reply card opposite page 36.

STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.

Automatic Sample Driver For Sub-Surface Exploration

49. This compact portable drilling unit features augering, driving and core drilling for sub-surface exploration. Check the reply card or write Penndrill Mfg. Div., Pennsylvania Drilling Co., 1201-1205 Chartiers Ave., Pittsburgh 20, Pa., for full information.

Traffic Protection with AmBridge Highway Beam Guard Rail and Posts

205. USS AmBridge beam guard rail can be furnished in 25-ft. lengths and with the steel posts make a strong, highly visible and economical guard rail. Check the reply card or write American Bridge, Division of United States Steel, Pittsburgh, Pa.

Illustrated Specifications on Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 505 York Road, Jenkintown, Pa., or use the handy reply card.

All-New Transistorized Mobile Radio

243. General Electric's complete, new transistorized mobile radios are available in 10, 30 and 75-watt ratings, 150-174 mc. The design of these units permit front-mounting in any make or model car or truck. For catalog on specifications, models and operation write to General Electric Co., Communication Products Dept., Lynchburg, Va.

Eaton 2-Speed Axles For Your Trucks

264. Truck axles that provide easy shift, supply positive lubrication and have a self-contained air brake are available from Eaton Mfg. Co. For complete information on these rugged axles check the reply card or write Eaton Mfg. Co., Cleveland, Ohio.

Hand Operated Soil Sampling Kit

366. Bulletin 26-R describes the Acker soil sampling kit that contains 12 different soil sampling tools packed in a handy steel case. Check the reply card or write to Acker Drill Co., Inc., P.O. Box 830, Scranton 2, Pa., for data on tools that are designed to take soil samples from practically any material.

Motor Graders With Torque Converter and Power Shift Transmission

430. Complete operation data and specifications of Huber-Warco motor graders are covered in Bulletin No. HWG521 available by checking the reply card or by writing Huber-Warco Co., Marion, Ohio.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

Portable Hot Asphalt Paving Repair Unit

250. Maximum economy in paving repair and maintenance is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Get latest data from Wylie Mfg. Co., 3926 N. W. 39th St., Oklahoma City 12, Okla. Use the reply card.

The Principles of Compaction by Vibration

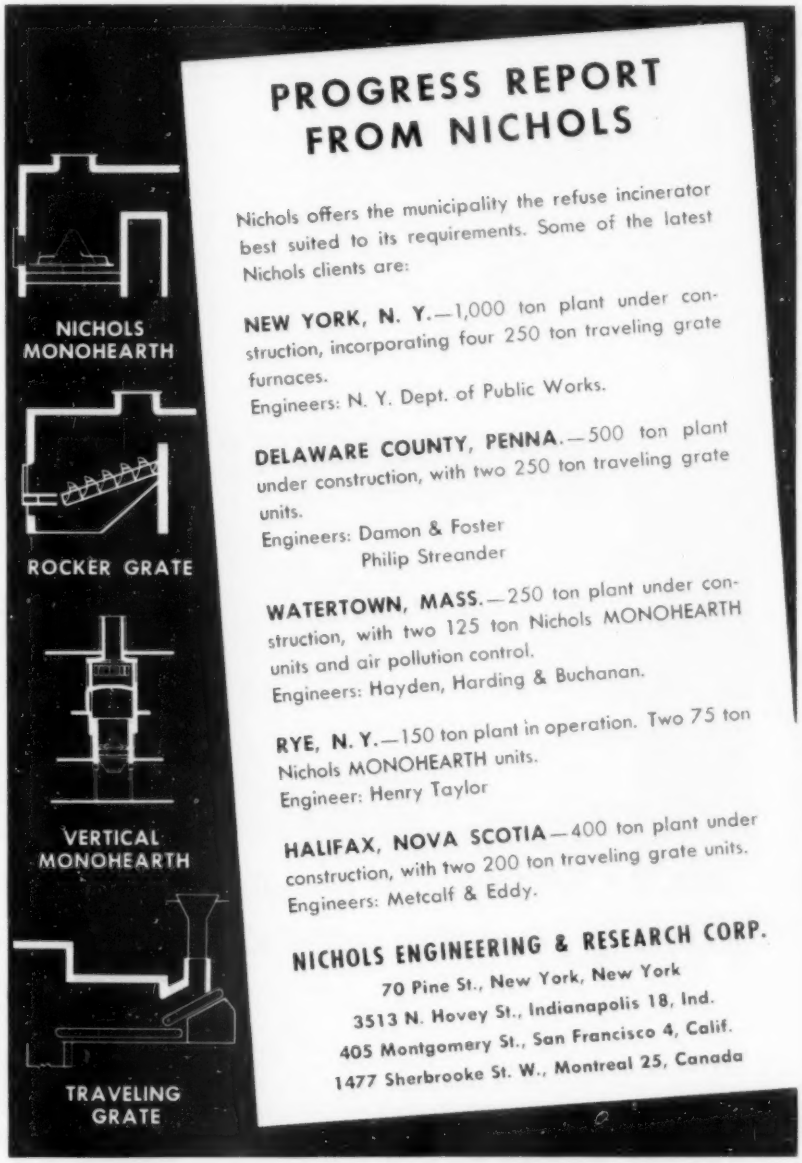
288. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1930 Sante Fe Ave., Los Angeles, Calif.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Power Tamper for Granular Soil and Bituminous Surfacing Work

342. The Kelley Power Tamper is a self-propelled unit that is equivalent to a 10-ton roller for backfilling, road widening jobs and compacting around culverts and pipeline trenches. For complete specifications write Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Hinman Ave., Buffalo 23, N. Y., or check the reply card.


NICHOLS MONOHEARTH
ROCKER GRATE
VERTICAL MONOHEARTH
TRAVELING GRATE
PROGRESS REPORT FROM NICHOLS
Nichols offers the municipality the refuse incinerator best suited to its requirements. Some of the latest Nichols clients are:
NEW YORK, N. Y.—1,000 ton plant under construction, incorporating four 250 ton traveling grate furnaces.
Engineers: N. Y. Dept. of Public Works.
DELAWARE COUNTY, PENNA.—500 ton plant under construction, with two 250 ton traveling grate units.
Engineers: Damon & Foster
Philip Streander
WATERTOWN, MASS.—250 ton plant under construction, with two 125 ton Nichols MONOHEARTH units and air pollution control.
Engineers: Hayden, Harding & Buchanan.
RYE, N. Y.—150 ton plant in operation. Two 75 ton Nichols MONOHEARTH units.
Engineer: Henry Taylor
HALIFAX, NOVA SCOTIA—400 ton plant under construction, with two 200 ton traveling grate units.
Engineers: Metcalf & Eddy.
NICHOLS ENGINEERING & RESEARCH CORP.
70 Pine St., New York, New York
3513 N. Hovey St., Indianapolis 18, Ind.
405 Montgomery St., San Francisco 4, Calif.
1477 Sherbrooke St. W., Montreal 25, Canada

To order these helpful booklets check the reply card opposite page 36.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

Pre-Assembled Dowel Units For Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Attachments For Ford Tractors

643. Clearing, backfilling, ditching, excavating, mowing, scarifying, sweeping, and trenching equipment are a few of the attachments described in literature from Tractor and Implement Div., Ford Motor Co., 2500 East Maple Road, Birmingham, Mich.

Transit Cranes for Bridge and Highway Building

691. Transit cranes that can lift 33,000 lbs. at 20-ft. radius, and 13,000 lbs. at 40-ft. radius with 60-ft. boom and outriggers set are described in literature from Bucyrus-Erie Co., South Milwaukee, Wisconsin. Also featured are load control, folding boom and boom lengths.

Helpful Data on Distributors for Bituminous Materials

611. Pressure distributors featuring uniform pressure and temperature, accurate displacement pumping, convenient operation are described in literature of Standard Steel Works, North Kansas City, Mo.

Are You Having Compaction Problems?

676. Small, self-propelled, one-man operated heavy-duty vibratory tampers enable you to compact any material to specifications. Literature available from Vibro-Plus Products, Inc., Stanhope, N. J., or by checking the reply card.

REFUSE COLLECTION AND DISPOSAL

What You Should Know About Refuse Incinerators

30. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217A and 223A from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the reply card.

Literature Describes M-B Contain-O-Pack System

190. A 6-page catalog describing the M-B Contain-O-Pack, a complete low cost containerized refuse system for private haulers and municipalities is available from M-B Corp., New Holstein, Wisc. Check the reply card.

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 6147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy reply card.

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletin W-200 explains how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card for full details.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Refuse Body and Loader Picks Up, Compacts and Dumps

583. In one-man operation the Econ-O-Packer front end loader speeds up residential collection with driver view loading and comes in body capacities from 28 to 40 cu. yds. Check the reply card or write Econ-O-Way Inc., 2675 Commercial St., San Diego 13, Calif., for details.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

Pick the right paint for the job

FREE PAINT INDEX

Whatever your painting problem, there's *one* paint especially formulated to give the *most effective* protection. With this handy guide, choosing that paint is simple and easy. Profitable, too, because the correct choice will wear longer, save you money on costly repaints. Write for your free money-saving Paint Index today!

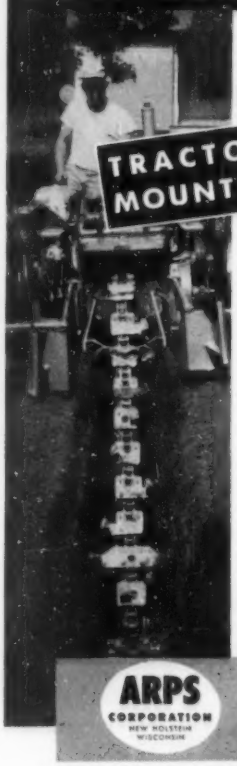
Heavy-Duty Maintenance Paints Since 1883

TROPICAL PAINT COMPANY

1174-1252 W. 70th, Cleveland 2, Ohio

PARKER RUST PROOF PRODUCTS

LOW COST TRENCHER

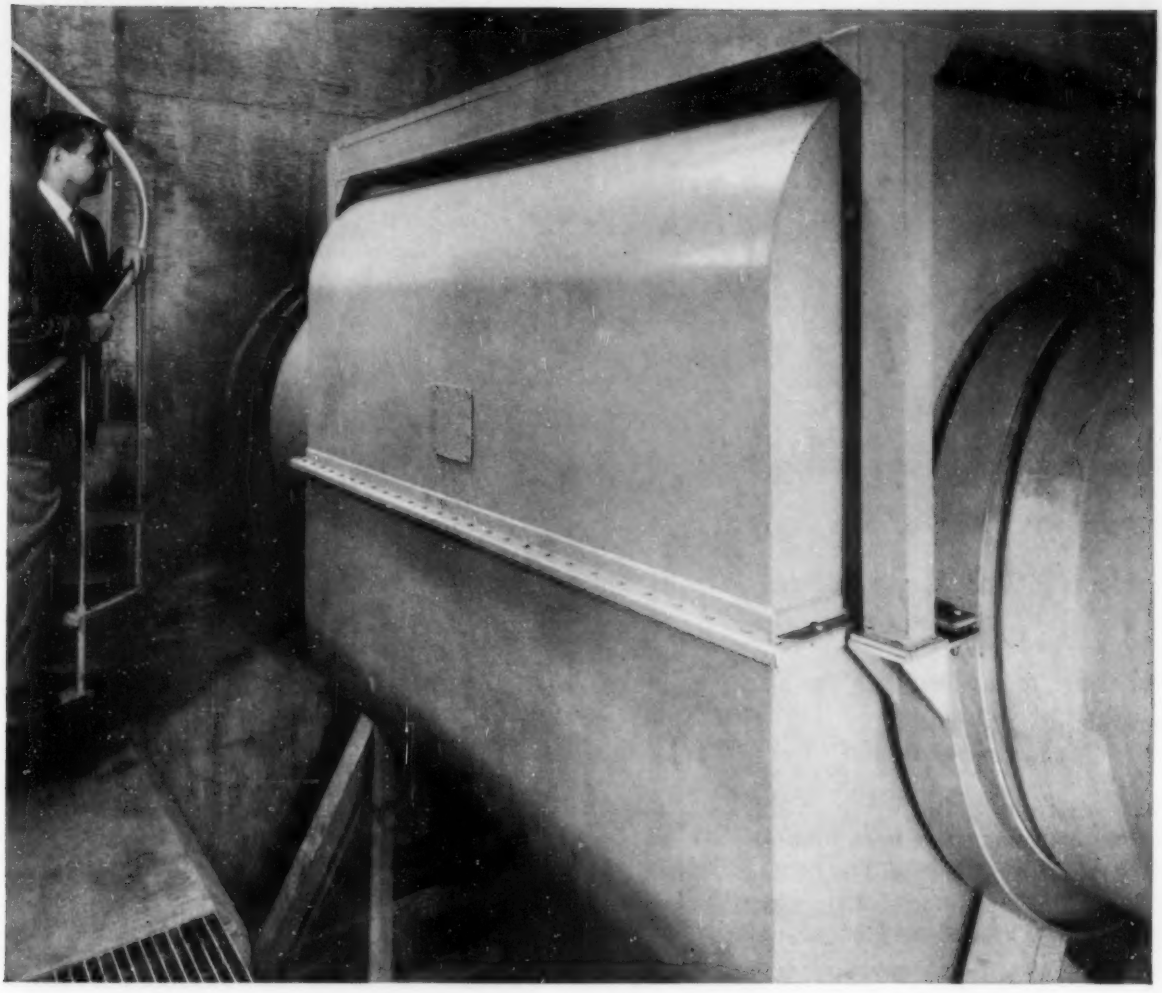


Fits Any Job... Fits Your Budget

Dig ditches faster, in less time and at lower cost per foot of trench with the versatile Arps Trench Hog. There's nothing better for telephone, electric, gas and water line trenches; foundations, septic tank installations, drainage ditches, sewer systems; and scores of other trenching jobs handled every day by contractors, utilities and municipalities. ■ Digs 3½, 5½ and 7 ft. deep in widths of 6" through 20"; full hydraulic depth control; mounts on all popular tractors; independent speed control for perfect digging on curves, too. ■ Get full details and name of dealer from the Arps Corporation, New Holstein, Wis., Dept. PW

ARPS CORPORATION NEW HOLSTEIN WISCONSIN

TRENCHERS • HALF-TRACKS
BULLDOZERS • UTILITY BLADES



at Orange County (Calif.) Sewage Treatment Plant:

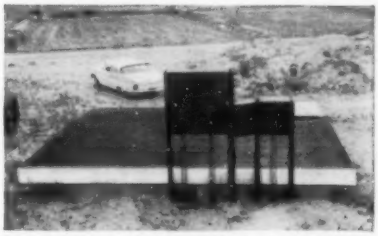
42" Foxboro Magnetic Flow Meter Handles up to 60 Million Gallons Effluent Per Day

giant meter has no flow restrictions of any type

The County Sanitation Districts of Orange County, Calif. have a total of 4 Foxboro Magnetic Flow Meters. The giant meter shown above measures effluent flow from Plant #1. Additional 16", 20" and 24" meters measure influent flows on trunk lines entering the plant.

Mr. Robert N. Galloway, Superintendent of Plants, reports that the 42" meter has required no maintenance whatever since it went on stream in the summer of 1958. The Magnetic Flow Meters, Mr. Galloway adds, not only furnish vital plant operation data, but more important, serve as the basis for apportioning costs to the various sanitation districts in Orange County contributing to the plant flows.

Measuring sewage is no problem for the Foxboro Magnetic Flow Meter. It has no orifice plates, no pressure taps, no line restrictions of any kind. There is nothing to corrode — nothing to take apart and clean. Ask your nearby Foxboro Field Engineer for full details or write for Bulletin 20-14. **The Foxboro Co., 269 Norfolk Street, Foxboro, Massachusetts.**



42-inch Foxboro Magnetic Flow Meter is installed in this cement pit, 25 feet below ground. Instrument at right is Foxboro Teletax Transmitter, providing instantaneous transmission of effluent flow measurements to Orange County's central operating station.

FOXBORO

REG. U.S. PAT. OFF.

engine power
BY CATERPILLAR

ANSWERS TO QUESTIONS ABOUT EMERGENCY POWER

Can you be protected against utility power loss?

What can cause utility power interruptions?

Who needs protection against power outage?

What kinds of standby power are there—and which is best for your application?

What things to consider when you plan standby power installation?

THESE are some of the questions you'll find answers to in "Guide Book Information for Emergency Power." Published by the Engine Division of Caterpillar Tractor Co., "Guide Book" discusses emergency power from many standpoints and completely in nontechnical language.

If you are responsible for a business or institution which must have electrical power to safeguard lives, protect equipment or sustain operation—the information in this booklet is important to you. You may obtain a copy, without cost or obligation, by writing to Department 3, Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

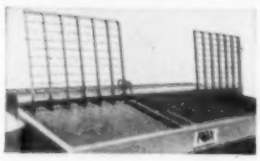
1959 SPECIFICATIONS for your files

FOX Mountable Materials Spreader

for sand • cinders • chips • salt • calcium chloride

MOUNTING

On or off any standard dump body in only 15 minutes. T-head fasteners, cranks and base adjustment channels make this possible. Truck is quickly freed for other work.

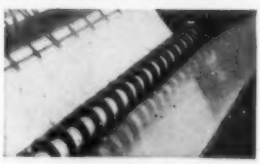


LOADING

Sturdy ⅛" rods make up cover grids that break up lumps. Allow only spreadable material to pass through. Increases spreading efficiency and prevents damage to mechanism.

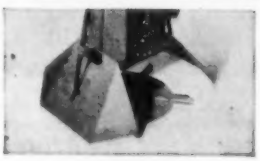
DASH-MOUNTED CONTROLS

Fingertip control from inside cab makes operation a one-man job. Panel includes—spreader engine ignition and starter switches, volume regulation control and electric clutch switch. Sanding at speeds up to 40 MPH.



FEED AUGER

Heavy-duty feed auger eliminates feed aprons and chains, the source of most frequent breakdowns. Auger mounted on 4 Timken tapered roller bearings, completely shielded from abrasives.



SPINNER

Adjustable for 8 to 40 foot spreading widths. Works close to ground—spreads under parked and passing cars . . . ahead and beneath rear truck wheels for added traction.

GENERAL SPECIFICATIONS

Model	Box Length	Box Width	Weight Empty	Capacity Heaped* (yards)
8S57	8'	80"	2435	5
9S57	9'	80"	2610	5¾
10S57	10'	80"	2849	6½
12S57	12'	80"	3156	8

*4", 6" and 12" height additions to box increases capacity—up to 12 cu. yds. on Model 12S57.

ENGINE —Wisconsin air-cooled, 18 H.P. @ 3500 r.p.m. with starter, generator and enclosed drive reduction.

BODY —10 gauge prime steel. All welded construction with reinforcing ribs.

BEARINGS —10 Timken tapered roller bearings and two sealed ball bearings plus engine bearings.

AUGER —Heat treated alloy steel, 7" O.D. progressive hard faced flights welded on 4" O.D. tube. Mounted on 4 Timken bearings.

CONTROLS —Manual controls outside driver's window, standard. Optional electric remote control panel on truck dash.

SPINNER —18" diameter. Height adjustable by 4 position lever for 8 to 40' spread.

MOUNTING —Quickly attached without drilling holes or welding.

GRIDS —⅛" rods on 3" centers. 4' and 5' sections.

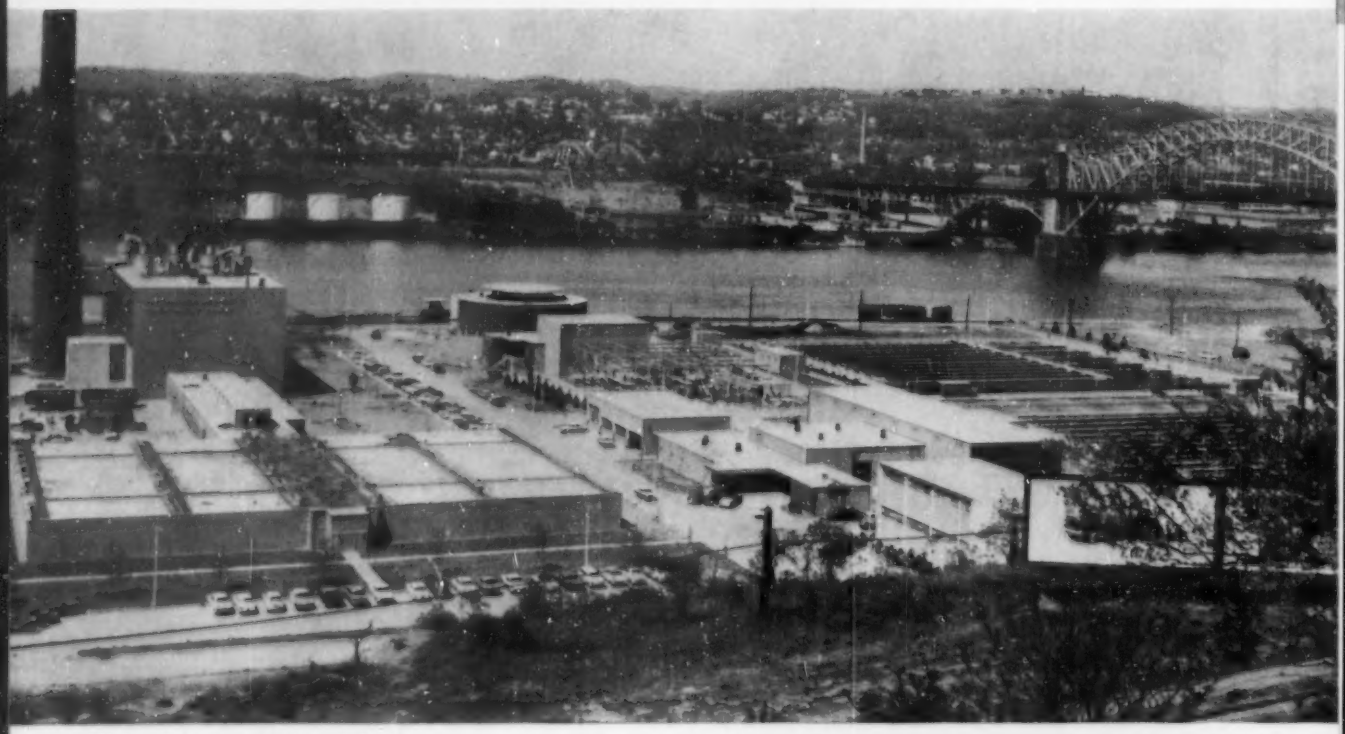
SPECIAL USES —Ideal as Seal-coater for summer road work. Special attachment converts unit to a Trench Filler.

The Fox Materials Spreader will cut your labor, time and equipment expenses to the bone. A catalog . . . case history reports . . . even a no-obligation demonstration are yours for the asking. Write, call or wire collect today. After you put a Fox Spreader into service, we'll be able to add your name to our growing list of satisfied users.

FOX RIVER TRACTOR COMPANY
Road Machinery Division
Dept. R3, 1020 N. Rankin St. • Appleton, Wisconsin
Phone—REgent 4-1451

For the entire city of Pittsburgh and 69 surrounding communities . . .

4-D Wrought Iron Pipe handles corrosive wastes

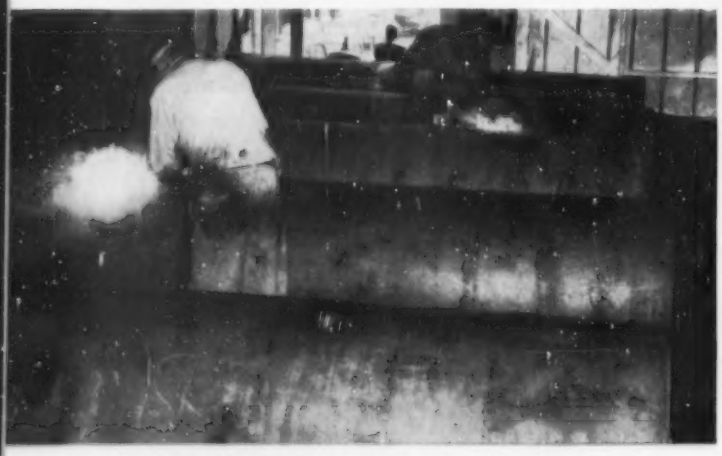


Pittsburgh Sewage Treatment Plant

Joint venture of Allegheny County Sanitary Authority Engineers and Metcalf and Eddy, Consulting Engineers, Boston, Massachusetts.

Installation: Wayne Crouse, Inc., Pittsburgh, Piping and Equipment
Sauer, Inc., Pittsburgh, Plumbing
Layne—New York Co., Inc., Pittsburgh, Downshafts

Architect: Celli-Flynn, McKeesport, Pennsylvania



Final welding on downshafts—Welders here complete transformation of ¾-inch 4-D Wrought Iron plates into 31-inch O.D. pipe. 4-D's self-fluxing action enables welders to easily produce sound, durable welds by any of the accepted welding methods. Elasticity of 4-D Wrought Iron prevents cracking during soil shifts or sudden jars in hauling.

Spray piping for sludge tank—Strung horizontally throughout nine sludge tanks are 270 lengths of 2-inch corrosion-resistant 4-D Wrought Iron Pipe. Spray nozzles, installed one foot apart, are tapped into each pipe run. Nozzles are set on 20-degree angles and aimed parallel to the sloped flush-down weirs.

in new Pittsburgh Sewage Treatment Plant

The new $80 million intercepting sewer and sewage treatment project in the Greater Pittsburgh area is about ready for business.

Built by the Allegheny County Sanitary Authority, the modern system will minimize sewage problems for 69 communities in the Pittsburgh district. The plant will handle 150 million gallons of raw sewage each day. This in turn will greatly reduce pollution in many parts of the Allegheny, Monongahela and Ohio rivers.

4-D WROUGHT IRON IN ALL THESE SERVICES

Hundreds of tons of corrosion-resistant 4-D Wrought Iron are involved in the processing of raw sewage at the new plant. Piping in sludge concentration tanks, chimney vents, tank car connectors and vertical downshafts, as well as force main, effluent, liquid chlorine, compressed air, waste, vent and conduit lines are all 4-D Wrought Iron.

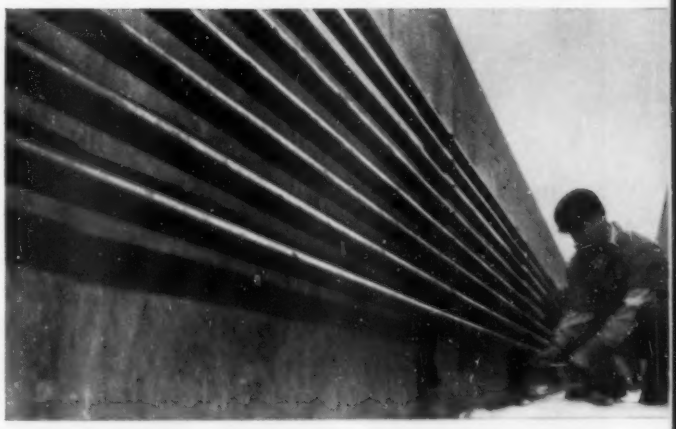
Diameter of the 4-D Wrought Iron Piping ranges from 1-inch to 36-inch O.D.

HERE'S WHY THEY USED 4-D WROUGHT IRON

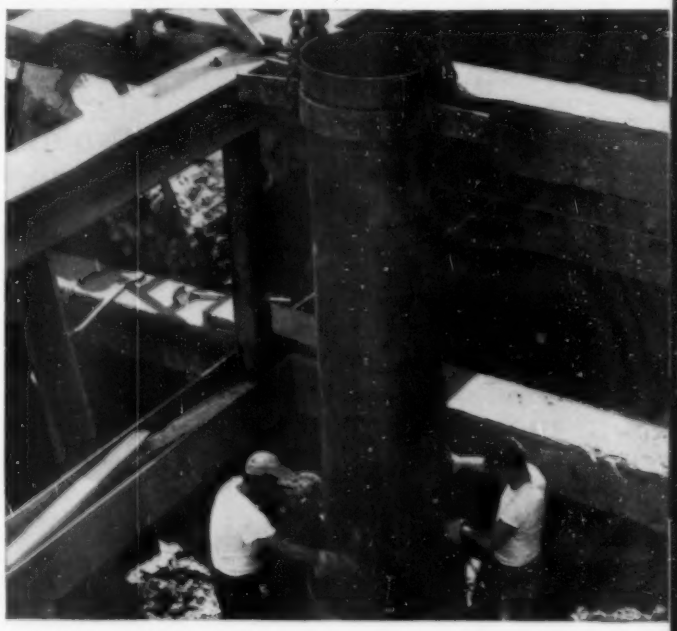
Wrought Iron's record of trouble-free service in demanding applications is well established. 4-D does its own job. Rarely needs costly protective coatings and wrappings. Successfully resists shock and vibration. Inherent elasticity prevents cracking. Long random lengths are available. So, fewer joints are required. Fewer hangers are needed. And 4-D Wrought Iron Pipe does not rely on excessive wall thicknesses to ward off corrosion.

SUMMING UP

Low cost per year of service is the sum and substance of these 4-D virtues. 4-D Wrought Iron lasts. Write for our booklet on sewage treatment and disposal installation. A. M. Byers Co., Clark Bldg., Pittsburgh 22, Pa.



Aligning liquid chlorine lines—One-inch diameter extra-heavy 4-D Wrought Iron Pipe, leading to plant's chlorine room, receives proper alignment prior to final inspection. A service as corrosive as chlorine piping calls for the piping longevity of 4-D Wrought Iron.



Coffin for corrosion—This 25-inch diameter 4-D Wrought Iron downshaft (¾" wall) spells doom for aggressive elements contained in corrosive raw sewage. 4-D Wrought Iron's unique composition of glasslike iron silicate fibers entrained in pure base metal, blocks corrosion as soon as it starts.

BYERS 4-D WROUGHT IRON

TUBULAR AND FLAT ROLLED PRODUCTS

Corrosion costs you more than Wrought Iron

A-M CONCRETE PIPE

tailored to the fill—
to save you money!

FOR HIGHEST FILLS AND HEAVY LOADS, Hi-Hed® is the *most economical* permanent sewer and culvert pipe because it is designed for minimum vertical load and maximum lateral support.

FOR AVERAGE FILLS, round concrete pipe is the *most economical* permanent conduit and American-Marietta saves added dollars through nationwide technical and manufacturing services.

FOR LOW FILLS, Lo-Hed® is the *most economical* permanent pipe because it offers maximum capacity under minimum cover and has inherent strength for greater resistance to impact.

AMERICAN-MARIETTA COMPANY
CONCRETE PRODUCTS DIVISION
GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING
101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

MATCHED TO THE LOAD . . . MATCHED TO THE ROAD . . .

quality components selected for your exact needs

Brockway HUSKIE

LONG PROFITABLE SERVICE under the ROUGHEST, TOUGHEST CONDITIONS

Your Brockway Huskie is designed and built to haul your load over the terrain you haul it. All major components — engine, clutch, transmission, axles — are matched and balanced to give you hauling power that fits the requirements of your job. Even the famous Brockway chassis is custom built. If trucks are the tools of your business, Brockway can point your way to higher profits.

Some of the NEW Brockway Huskie features:

- *Wider choice of power — gasoline or diesel*
- *Larger cooling capacity*
- *Improved power steering*
- *All steel, Safety-View cab*
- *Dual headlights*
- *Step-Aside fenders*
- *Easy-Access maintenance*

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BROCKWAY MOTOR TRUCKS CORTLAND, N. Y.

Division of Mack Trucks, Inc.

Only from GAR WOOD... BIG

Gar Wood Pax-all Refuse Containers snap quickly on or off the new Load Packer 600 without use of chains or cables. Complete hydraulic operation is controlled with one lever

Always specify GAR WOOD for greatest equipment operating

GAR WOOD's rugged ¾ yard machine gives you bonus capacity for excavating and material handling. Independent travel lets operator hoist or swing while moving... built-in chain crowd puts full engine power into every bite, simplifies conversion.

GAR WOOD - ST. PAUL hoists and bodies deliver longer, dependable service with a minimum of maintenance. The rugged yet precision hydraulic system handles controlled dumping smoothly, quickly, accurately ... under the toughest conditions.

SIX Performance

with the NEW LOAD-PACKER® 600

Only from BIG SIX performance of the new Load Packer 600 can you get advanced engineering features that insure lowest operating and maintenance costs... faster, more productive time... years of extra service.

Exclusive BIG SIX performance features of the new Load Packer 600 out-match any other equipment in these six important ways...

1. **FASTEST OPERATION**—Crew starts reloading in just 4 seconds... full cycle takes only 10 seconds. More speed means better service.
2. **GREATEST COMPACTION**—Direct thrust compaction packs more per yard than any competitive unit.
3. **BIGGEST LEGAL PAYLOADS**—Minimum dead weight. Front-mounted telescopic hoist eliminates the need for heavy, conventional hoist sub-frames. Result: less weight and greatly improved weight distribution.
4. **LARGEST, LOWEST HOPPER**—Big 1½ cubic yard, 74" wide hopper, plus low loading height speeds collection, makes crew's job easier. Three crewmen can load simultaneously.
5. **SAFEST, MOST DEPENDABLE OPERATION**—Controls are simple, foolproof. Operator has positive control, can stop mechanism instantly. Engineered for less maintenance with fewer moving parts, less linkage, fewer adjustments.
6. **GREATEST ECONOMY**—Big hopper, fastest loading cycle means less fuel consumption... less wear and tear on packer, chassis and engine.

The new Load Packer 600 is first with every feature that counts! Get the complete 600 story from your Gar Wood-St. Paul truck equipment distributor.

and maintenance economy

GAR WOOD-BUCKEYE wheel- and ladder-type ditchers offer modern features like these as standard equipment at no extra cost: hydraulic conveyor drive, hydraulic digging wheel hoist, modern power train and simplified group controls.

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IT'S NOT THE INITIAL COST

it's the upkeep...

Competitive bidding on water works projects has brought the price of comparable pipes of different specified materials to a nearly common level. Today, the important consideration for the buyer is not so much the first cost as the maintenance charges which continue throughout the life of the pipeline.

In any such comparison, the superiority of LOCK JOINT CONCRETE PRESSURE PIPE is demonstrated by the experience of hundreds of municipalities. For example, records of one of the country's largest industrial cities indicate only minor maintenance or repair charges in the last 10 years against more than 18 million inch feet of LOCK JOINT CONCRETE PRESSURE PIPE in its water works system.

Your city, too, can virtually eliminate maintenance expense, and **save many times the initial installation cost with Lock Joint Concrete Pressure Pipe.**

LOCK JOINT PIPE CO.

East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich.
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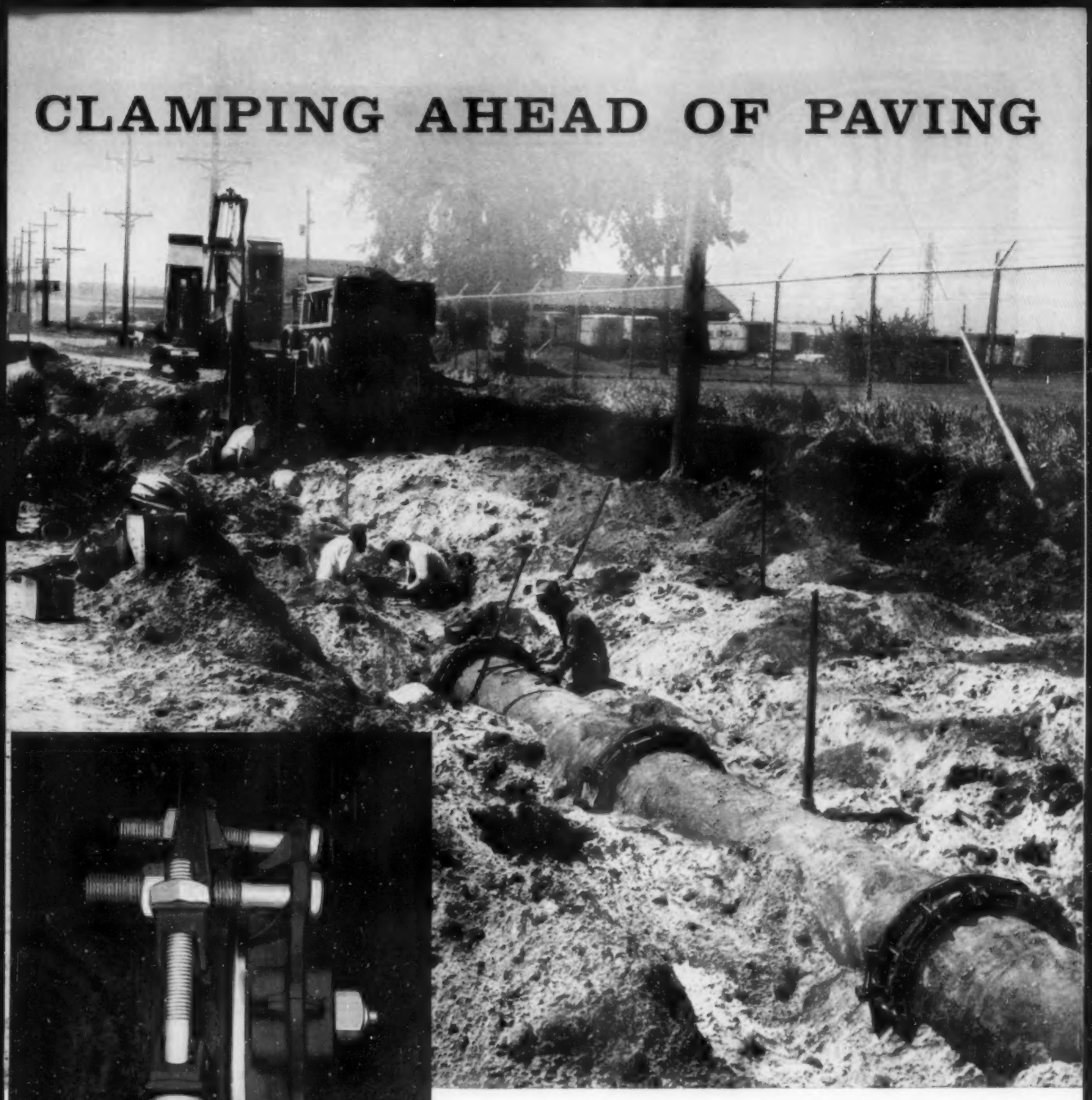
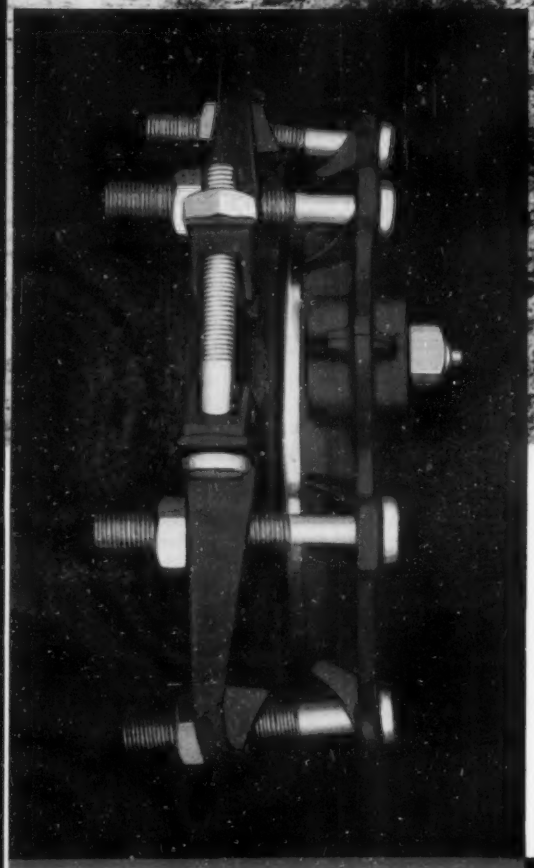
Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

CLAMPING AHEAD OF PAVING





More and more, clamping bell and spigot joints ahead of paving is becoming standard practice around the country.

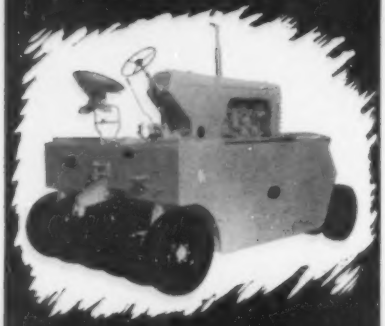
When you clamp with the Skinner-Seal Bell Joint Clamp, you get massive malleable iron construction, gaskets sealed by monel band, oversize corrosion resistant bolts.

For over 50 years, our clamps have been built for permanence. Every detail of design and construction is worked out with that in mind.

M. B. SKINNER CO., SOUTH BEND 21, IND.

SKINNER-SEAL BELL JOINT CLAMP

TAMPO means COMPACTION Plus
EQUIPMENT DESIGNED FOR EVERY JOB

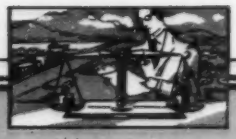


SELF PROPELLED
9 and 11 WHEEL MODELS

- SELF PROPELLED PNEUMATIC tired rollers give faster production results for finishing rolling, base work, seal coats and asphalt mats. Uniform wheel loads and kneading action of the tires give uniform densities and smooth surfaces.
- TAMPO pneumatics have the fastest reversing cycle—automatically—with single lever control.
- TAMPO pneumatics have completely equal wheel loads, absolute visibility and every comfort for the operator.

20th ANNIVERSARY

TAMPO MANUFACTURING COMPANY
BOX 4248, STATION A
SAN ANTONIO 7, TEXAS



LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Sidewalk Defect

Hunt v. Tooele City, 334 P. 2d 555, decided by the Supreme Court of Utah Jan. 22, 1959, was an action by a pedestrian against a city for personal injuries sustained in a fall on a depressed portion of sidewalk, curb and gutter.

About 9:30 A.M. on a clear morning on April 10, 1957, plaintiff, desiring to do some shopping, was driven by her daughter-in-law to Main Street in Tooele, Utah, where the car was parked at a 45 degree angle to the curb immediately west of where the Penney Store and the Allen Grocery Store adjoin. She got out of the right side of the parked car and walked straight from the car to the sidewalk, then angled south to the grocery store where she did her shopping and emerged carrying two bags of groceries. On the way back she proceeded to the curb about five feet south of where her daughter-in-law's car was parked, and while watching to see where an oncoming car was going to be parked, at the time observing where she was walking, she suddenly felt her left foot tip, and she fell into the gutter. When she turned around to see what caused her fall she saw the hole in the curbing into which she had stepped and which had caused her to lose her balance.

The break in the curbing was approximately 17 inches long, 7 inches deep, with the top part about 4 or 5 inches wide. There was a break in the gutter about 77 inches long, 10 inches wide and 3½ inches deep. These defects had existed for several years.

The curb was broken straight down, and cement had been poured into a hole which was there and which left cement extending over it and into the curb. This cement filling gives an impression that the sidewalk is continuous.

The city did not deny its negligence, but contended that it was not liable because of the plaintiff's contributory negligence.

The Supreme Court upheld the trial court's finding that there was no contributory negligence and affirmed a judgment for the plaintiff.

Obstruction of a Watercourse

Corrington v. Kalicak, 319 S.W. 2d 888, decided by the St. Louis Court of Appeals Jan. 6, 1959, was an action by property owners against a city and a contractor for damage to their property by water diverted over their property when logs, stumps and debris accumulated during a rain against scaffolding and form work used in the construction of a bridge over a stream, obstructing the flow of water.

The court held that the plaintiffs were entitled to maintain their action, regardless of whether or not there was negligence. This was a trespass, and the rule of strict liability applies. The city was not immune from liability, since it had no authority to obstruct the stream.

Burning Rubbish

Carter v. City of Greensboro, 249 N.C. 328, 106 S.E. 2d 564, decided by the Supreme Court of North Carolina, was an action by a minor against the city to recover for burns sustained by reason of the city's negligence in kindling and leaving unattended a trash and rubbish fire on grounds surrounding the public housing unit in which the plaintiff lived.

The defense of the city was that notice of his claim had not been given the city within six months, as required by the City Charter.

The court held that it was proper to allow the trial jury to find that his physical or mental incapacity made it impossible to give the required notice—in view of the fact that he was only three years old

Lightweight, easy-handling aluminum signs go up fast. While R. J. Colpitts looks on, foreman Omer Lane easily installs this sign in only 10 minutes. Alhambra's signs are fabricated from Kaiser Aluminum blanks with reflectorized sheeting by the Mask-Off Company of Monrovia, California.

"For our money, only cost-saving aluminum signs will do!"

... says R. J. Colpitts, Traffic Engineer, Alhambra, California

"We like aluminum traffic control signs because we are able to get the type of sign we want—with both initial and long range savings over other materials," reports R. J. Colpitts, Traffic Engineer, Alhambra, California.

"And we know we'll save plenty on maintenance and replacement costs, as well. With rustproof aluminum, the oxidation problem is reduced to an absolute minimum. There's no need for us to protect the edges and back surfaces of our signs.

"What's more, because aluminum signs are so easy to work with, they give our sign shop greater flexibility. We can tailor-make our sign program to suit our particular needs with little added equipment.

"No doubt about it. With us, it's aluminum traffic control signs all the way!"

KAISER ALUMINUM

THE BRIGHT STAR OF METALS

Let us make a bid. For expert service on money-saving aluminum signs, call the manufacturer, fabricator or Kaiser Aluminum sign blank jobber near you.

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Chicago, Ill.
Belf & Gustus, Inc.
Federal Sign & Signal Corp.
Spencer, Ind.
Stello Products
Cleveland, Ohio
Osco Steel Co.
U. S. Steel Supply
Clinton, Mass.
Standard Sign & Signal Co.
Dallas, Tex.
All Quality Sign & Mfg. Co.
Elmira Heights, N. Y.
Eastern Metals of Elmira, Inc.
Evanston, Ill.
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Grand Prairie, Tex.
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Houston, Tex.
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Little Rock, Ark.
Moody Equipment & Supply Co.
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Minneapolis, Minn.
Lyle Signs, Inc.
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Send now for free brochure. Gives cost-saving facts and availabilities on traffic control signs made of Kaiser Aluminum. Mail coupon today.

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Oakland 12, California

☐ Please send me your free aluminum sign brochure

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New York's leading bank has the men and the experience you need to handle Municipal Trust details at high-level efficiency.

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Any municipal or governmental unit considering a bond issue will find it profitable to talk to the people at Chase Manhattan.

Chase Manhattan's Trust Department is staffed with people long experienced in every detail of acting as Municipal Trustee and Fiscal Agent. Their experience and technical skill enable them to serve you efficiently and administer any agreement, no matter how complicated.

The range of Chase Manhattan trusteeship runs from the nation's biggest toll roads to its most expansive utilities. Chase Manhattan municipal trust customers extend to every corner of the free world.

If you are an officer of a municipality or a governmental unit, talk to the people at Chase Manhattan about your trusteeships. The address is 40 Wall Street, New York 15. The telephone number—HAnover 2-6000.

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at the time, that he was without a guardian, that his mother was of limited education and was later divorced, and that the whereabouts of his father was unknown.

Electrical Boxes in Sidewalks

McChain v. City of Fond du Lac, 96 N.W. 2d 607, decided by the Supreme Court of Wisconsin May 5, 1959, was an action for injuries sustained by a pedestrian in a fall caused by a depression in a sidewalk on Main Street in the city of Fond du Lac, i.e., an electrical junction box ¾ of an inch below the level of the sidewalk.

The city electrician stated that the junction box consisted of a steel frame 14 inches square with the cover attached by screws and at the time of its installation was level with the curb; that after the sidewalk was constructed, which varied in pitch and height along the street, all the junction boxes were adjusted, including the one in question, to make the top of the boxes level with the sidewalk. Four years later, the junction box in question had settled below the level of the sidewalk ¾ inch.

The court held that as a matter of law the city was not liable; there was not such a want of repair as to constitute negligence, nor did the depression in the sidewalk constitute a nuisance.

• • •

Traffic Fatalities in Indiana

Seventy-two percent of all pedestrians killed in Indiana in 1958 were aged under 10 or were 60 years and over. Grandparents and grandchildren both need to study and use safe walking practices. County roads, carrying about 8 percent of the total motor vehicle miles traveled in the state, had 20.3 percent of all traffic fatalities. More fatal accidents occurred at night than in daylight. This was true on state highways, on the toll road and on city streets. County roads had the opposite experience with 56.9 percent occurring in the daytime. Forty percent of all fatal accidents on County roads were one car accidents in which the car ran off the roadway. This type usually results from speed too fast for conditions.

Trailer Park Rates

The rates for the new trailer park at Tyler, Minn., are: $2 per day, $7.50 per week and $15 per month. Each trailer owner occupying space in the park will be required to deposit $20 to cover electrical services.

CONCRETE PERFORMANCE REPORT:

POZZOLITH concrete employed to meet full range of engineering requirements for all types of concrete specified

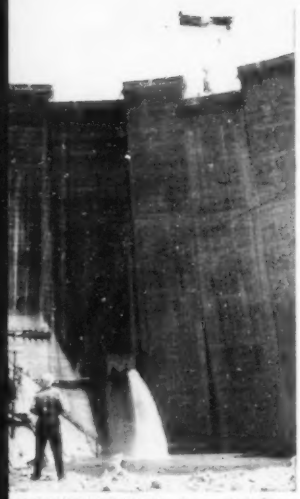
TULLOCH DAM stretches nearly 1/3 of a mile across the Stanislaus River. Here POZZOLITH Retarder proved particularly benefical in mass concrete during summer months when the temperature soared to 110°F.

TRI-DAM FACILITY is jointly owned and operated by the Oakdale and the South San Joaquin Irrigation Districts, California. Design Engineers: George T. Goodall Co. & International Engineering Co., Inc. • Project Engineers: Tudor-Goodenough Engineers • Contractors: Donnells Dam and Beardsley Dam—Tri-Dam Contractors (a joint venture by Morrison-Knudsen Co., Peter Kiewit Son's Co., Macco Corp., and Stolte, Inc.); Tulloch Dam—The Arundel Corp. and L. E. Dixon Co.

The Tri-Dam Project in south-central California is one of the most interesting hydraulic programs undertaken in recent years. Each of the three structures represents a different basic type of dam being constructed in North America today.

Donnells Dam is a graceful concrete arch. Tulloch Dam is a concrete gravity structure and Beardsley Dam a rolled earth dam with a concrete spillway.

TRI-DAM PROJECT



DONNELLS DAM rises 480 feet above foundation. This project included construction of a 7-mile long concrete-lined tunnel, penstock and powerhouse.

Evaluation Tests—approximately 16,000 yards of plain concrete had been placed at Tri-Dam when laboratory tests and field trials showed that: POZZOLITH, with the cement and aggregates already in use, would lower the rate of temperature rise in mass concrete, reduce total heat evolved and provide other basic improvements in quality . . . and that substantial savings in the cost of concrete would result. It was decided to employ POZZOLITH in the balance of the 500,000 cubic yards to be placed.

A wide range of mixes was used at Tri-Dam and ambient temperatures varied from 110° to below freezing. POZZOLITH aided the placing operation in all situations encountered. Strength and other performance requirements were met with important savings in cost of concrete—savings of $172,500 on the entire project, according to cost records.

Throughout the project, Master Builders field men assisted in solving on-the-job concrete problems . . . adding their experience and know-how to that of Tri-Dam Project engineers, contractors and concrete suppliers.

On your current and future projects—call in the local Master Builders field man. At no cost, he'll demonstrate—with your materials—how concrete produced with POZZOLITH becomes a more versatile and more useful building material . . . superior in performance, in quality and in economy.

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BEARDSLEY DAM—an earth fill dam with concrete spillway. The structure is 1,000 ft. long and 280 ft. high.

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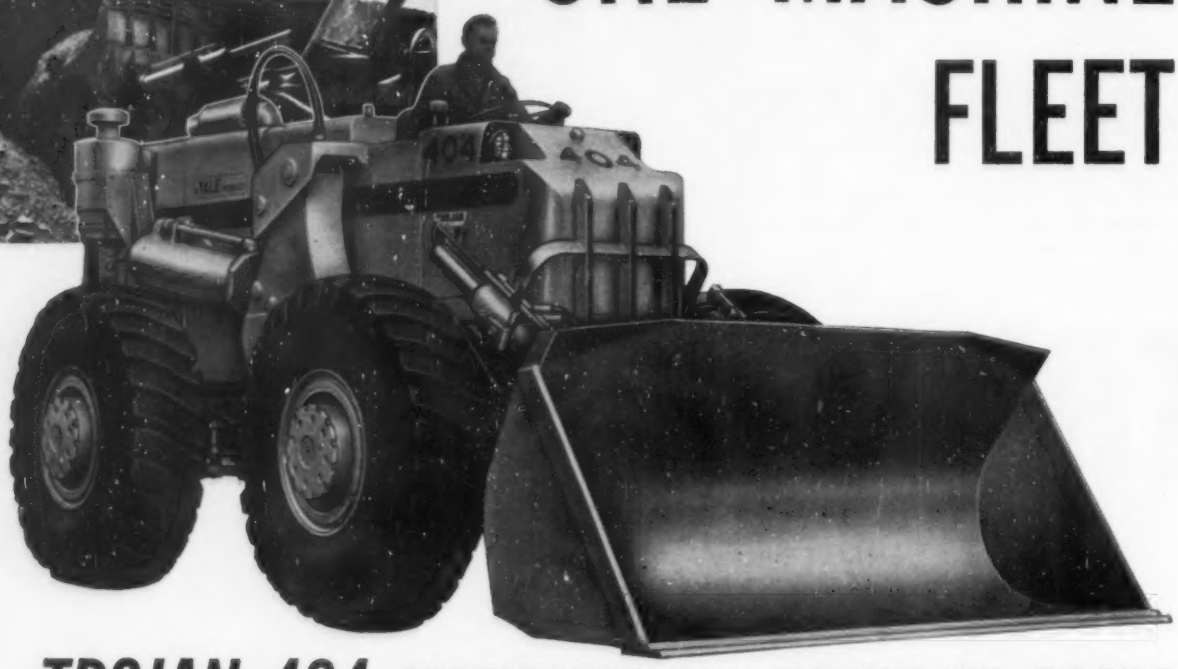

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A "one machine fleet" best describes the everyday performance of the Trojan Model 404, purchased by the Township of LeRoy, New York. Mobility, plus Trojan's thirst for work, has shrunk the size of the Township and taken over jobs normally handled by other types of equipment . . . Hank Sheridan, superintendent of roads for the Township says, "Right now we're using our rig for loading haul trucks here in a gravel pit. Tomorrow we might be using it to pull out trees 20 miles from here; or cleaning up fence rows 15 miles from the trees; or any of a number of other duties this multi-purpose rig has taken over . . . Working in conjunction with our portable crusher, the Trojan 404 proved so productive we had to hire another truck to back up the three we already own." The Trojan 404 is doing a job for LeRoy, it can do the same for you . . . Contact your local distributor — let him demonstrate Trojan ability.

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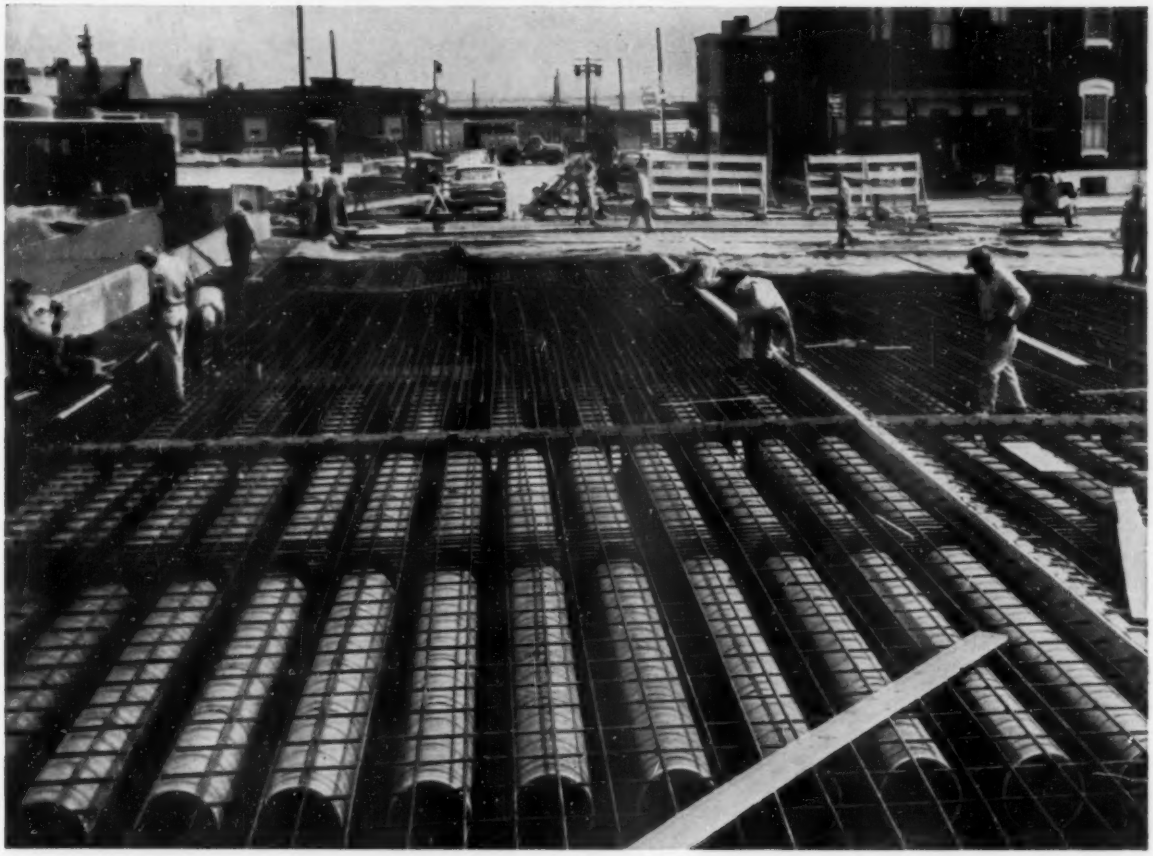

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Millions of cubic yards of concrete are being poured into St. Louis' big new system of freeways—one of the most enterprising urban highway building programs in the country.

In this overpass section of the Mark Twain Expressway between downtown St. Louis and northwest suburbs, concrete and weight are both being saved without sacrifice of strength. 15¾"-diameter fibre tubes, inclosed in a grillwork of Laclede Multi-Rib Round Reinforcing Bars, form the core of the 24½"-thick deck. While volume and mass are substantially reduced, the Laclede-reinforced deck maintains full load-bearing capacity.

MISSOURI HIGHWAY DEPARTMENT
Project No. 1-70-5(23)242
Mark Twain Expressway, St. Louis Ave. Bridge
Contractor: Fred Weber Contractor, Inc.

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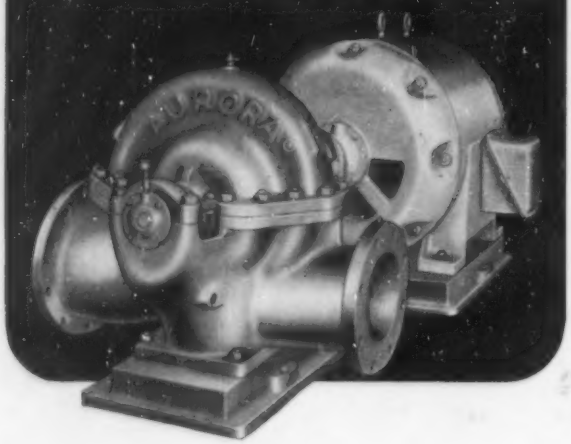

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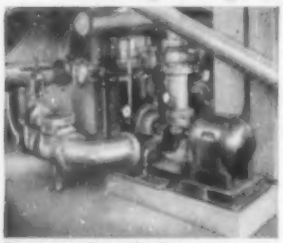

Two Aurora Type "O" Centrifugal Pumps, driven by 15HP, 1150 RPM motors are serving as cooling tower pumps in the plant of C. Schmidt & Sons, Inc., Brewers, Philadelphia, Pennsylvania.

Two Aurora Type "O" Condensation Water Pumps are installed in the Hillsborough County Courthouse, Tampa, Florida. Duty, 1400 GPM against 50' TDH at 1750 RPM.

Whether municipality or industry, you want a pump built for long, maintenance-free life. Equally important, when maintenance *is* needed, you want lines back in service fast!

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Commentary

on Water and Sewage Treatment

ELUTRIATION

R. S. RANKIN

Consultant, Water and Sewage Treatment

ELUTRIATION of digested sewage sludge prior to dewatering on vacuum filters is a valuable economic tool when properly applied. On the other hand inadequate consideration of certain factors can create problems affecting the entire plant. In the elutriation facilities at some plants these factors have apparently been ignored or not recognized while at others the successful performance confirms their importance. The two factors having direct influence on performance are the solids and the hydraulic loadings per unit of area of the elutriation tanks. This influence can be illustrated by examples of operating installations.

Elutriation, which means "washing out", had been practiced for many years in the chemical and metallurgical industries when Genter in 1934 proposed it for applications in the treatment of sewage sludge, and in 1935 obtained a patent on it. In industrial applications three or more stages of countercurrent elutriation or washing are frequently found, whereas in the treatment of sewage sludge not more than two stages are used. Applied to digested sludge, elutriation washes out the liquid products of digestion which are high in bicarbonate alkalinity and hence high in demand for the coagulant necessary for successful filtration.

Much has been written on methods of calculating the coagulant demand of sludges of different characteristics. Genter's (1) thorough discussion of this subject including corroborative evidence from operating plants furnishes practical means for computing chemical and elutriating water requirements for typical sludges. With adequate analytical data, any operator can determine the theoretical amount of ferric chloride needed to produce a filterable sludge. Incidentally in the United States ferric chloride, first applied by Palmer at Chicago, has become the accepted coagulant for use with vacuum filters following elutriation.

With these excellent facilities for determining the theoretical amounts of chemicals and elutriating water, the question of size of the physical plant to carry out the process of elutriation naturally arises. What overflow and solids loading rates are applicable, also what detentions should be used? Except for brief mention of detention such practical questions are not found in any of the papers discussing the advantages

This is only one of many city jobs handled by the versatile Cat No. 955 Traxcavator

After loading the stockpiled fertilizer, this No. 955 Traxcavator at Burley, Idaho, may head for any number of jobs. Its next assignment may be to excavate pit run gravel for streets, root up unwanted trees, remove snow, dig trenches and drains, or dispose of garbage. It does them all quickly and does them well.

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The No. 955 is a high-production machine. Its 1½ cu. yd. bucket can be tilted backward a full 40° at ground level to pry a full load on every pass—even with hard-to-penetrate materials. Superintendent John Carroll describes the No. 955 this way: "... it's fast and has a lot of power. The bucket is full the minute you start to raise it. Others don't do that. It's a good piece of equipment." The operator says, "I like the controls better on this machine. The bucket comes right up and the machine is balanced. It doesn't tip forward when loaded."

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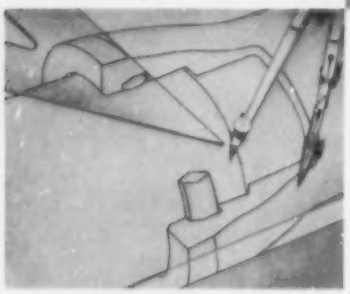
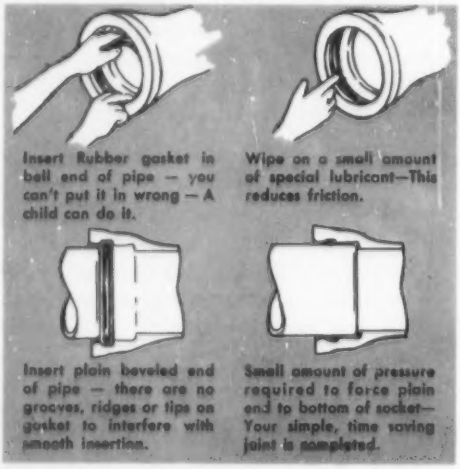


The **ALTITE JOINT** has been subjected to a series of rigid tests much more severe than are encountered under the most extreme installation and service conditions in the field. Even under extreme conditions, this joint is so simple to install—you could hardly go wrong if you tried.


Insert Rubber gasket in bell end of pipe — you can't put it in wrong — A child can do it.
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of elutriation. Possibly they were considered of so little importance that they could be disregarded. Whatever the reasons, it is now apparent that successful elutriation requires more than the application of quantitative formulae. Some installations have been very successful in performance while others have been quite disappointing. To discover the reasons for success or failure to perform as anticipated one can look to industrial applications and the methods employed there for sizing of units.

In all industrial applications the tank sizes are based primarily on solids loading per unit of area with liquid loading being incidental or secondary. When elutriating sewage sludge the solids concentrations are far beyond those encountered in ordinary sedimentation. A sludge with 4% solids for example, has 40,000 mg/L, and even when diluted with wash water, solids concentration usually exceeds 10,000 mg/L. Comparison with primary sedimentation where corresponding concentrations seldom exceed 250 mg/L indicates that the solids are more than incidental and consideration must be given to their area requirements as well as to that of the liquid. Successful elutriation requires not only the washing out of unwanted alkalinity but also the efficient retention and rethickening of the solids in the feed.

Considerable progress in thickening various types of sludges ahead of digestion has been made over the past six years and much has been learned about their settling characteristics. Loadings of from 8 to 20 lb. of dry solids per day per sq. ft. of thickener area are now recommended for best results on raw sludges and there is no reason to expect any increase in rates for digested sludge. In confirmation of this conclusion, Anton Sparr (2) in an excellent article written in 1954 called specific attention to the effect of solids loading on elutriation tank performance. An analysis of these carefully conducted full scale plant tests shows that a loading of not over 15 lb. of dry solids per day per sq. ft. combined with liquid overflow rate of 175 gal. per sq. ft. per day was necessary to retain 95% of the solids in the system. Higher loadings resulted in a substantial loss of solids into the effluent.

Bargman (3) in an article on sludge conditioning at the Los Angeles Hyperion Plant discusses at length the poor results of the elutriation tanks which failed to perform as anticipated. He states that when processing 160 tons of dry solids per day, only 92 tons were recovered and sent on to the dewatering plant, the difference escaping in the overflow. The size of the elutriation tanks is not mentioned but other published articles describing the plant state that each elutriation tank has an area of 7500 sq. ft.; 160 tons applied to a tank with 7500 sq. ft. results in a loading of 42.6 lb. per sq. ft. per day which is three to four times the maximum rate found necessary by Sparr for the successful recovery of solids. Another factor contributing to poor performance at Los Angeles is the relatively high volatile constituent (55-60%) of the digested sludge.

One example of an elutriation system which has continually reported satisfactory operation is illustrated in the published report of operation of the Metropolitan District Plant at Hartford, Conn. (4). For 1951-52, the latest available, the report shows 2.35 mil. lb and 5.49 mg of digested sludge elutriated in 90 operating days. Each elutriation tank has an area of 2040 sq. ft. so that the loading was 12.8 lb of dry solids per sq. ft. per day. Amount of dilution water is not stated, but assuming a 3 to 1 ratio, the

"On the New York State Thruway . . .

WE SAVED 50% IN LABOR AND MATERIAL COSTS . . . WITH BERMICO PARQUAY CONDUIT"

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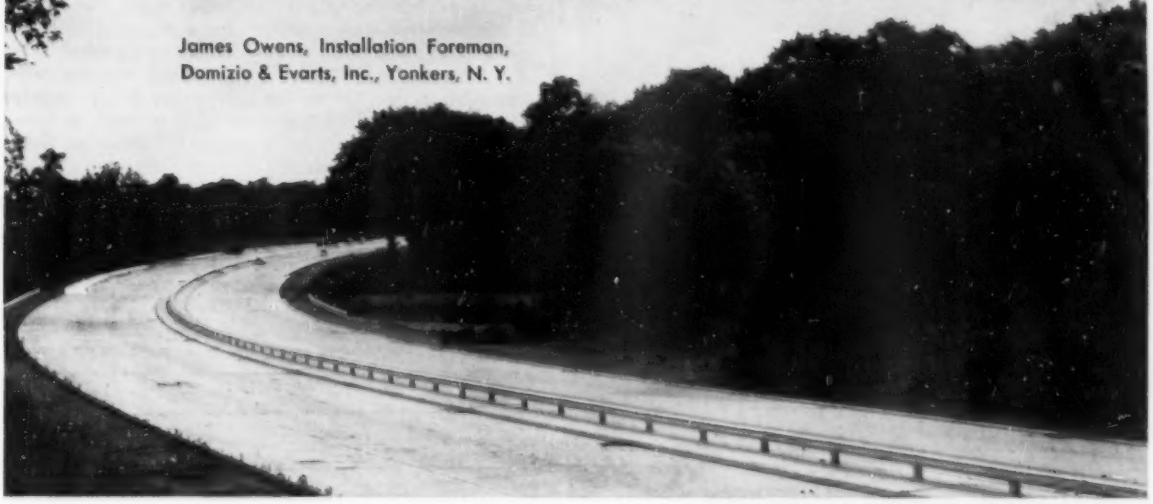
Domizio & Evarts, Inc., Yonkers, N. Y.



General view of New York State Thruway

"Installing Bermico ParQuay Conduit along the Thruway was easy," commented Mr. Owens. "This direct burial conduit is the ideal conduit for roadside use. No concrete encasement is necessary. We just laid six or eight lengths in the excavation trench at a time, quickly joined them using fibre couplings, then backfilled with clean fill."

"Where lengths had to be especially cut and fit," went on Mr. Owens, "we used a portable hand tooling machine, and we cut our coupling time 1/3 . . . compared with metal thread joints required by other types of conduit."

Bermico ParQuay (pronounced parkway) Conduit is simple to lay. It is made from special cellulose fibre, impregnated with coal tar pitch. Each 8-foot length is precision engineered, with smooth inside bore to allow easy cable pull-through without abrasion. It is long-lasting . . . extremely resistant to acids, alkalies, heat, water and corrosion. Try Bermico ParQuay Conduit on your next street or runway lighting job, or wherever direct burial conduit may be utilized.

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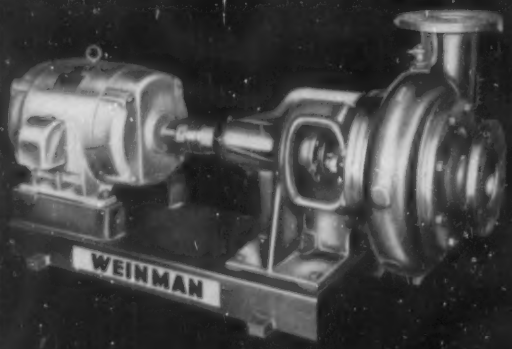

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You can depend on Weinman Type U-B pumps. They won't clog . . . easily handle liquids carrying large solids, stringy or fibrous trash and material suspended in sludge form.

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overflow rate was 120 gal. per sq. ft. per day. Volatile content of digested sludge was 46.3%. The design factors employed seem liberal for those days but results have amply justified them.

Where sludge is thickened ahead of digestion, one result makes elutriation almost imperative before conditioning ahead of filtration. This is the marked increase in alkalinity in the digested sludge which may reach 5000-6000 mg/L due to the concentration of anaerobic digestion products. With two stage elutriation and a moderate increase in elutriation water, chemical requirements need be no more than for conventional digestion. In such applications, three-stage countercurrent elutriation might even be justified. Three stages have never been used on sewage sludge but there is no reason for avoiding them if economically justified.

Some have expressed the opinion that future developments of chemical coagulants may make elutriation unnecessary. While this is possible it appears that properly designed elutriation systems would still be economically justified because it is unlikely that any purchased chemical can be as cheap as water, the prime ingredient of elutriation.

One other element of design not mentioned is that of detention. Detention becomes important as unit loadings increase, but in the range of loadings for successful operation, the effect of detention diminishes. However, where filters are operated a few hours daily for five days a week and elutriation is continuous which is most economical, then capacity for storage of elutriated solids must be considered. Requirements for over the week end will seldom exceed a depth of 3 or 4 ft. in the elutriation thickeners and this may readily be provided in standard units by increasing the depth.

Elutriation can be successful providing designs include loading rates from 10 to 15 lb. of dry solids per sq. ft. per day and hydraulic loadings up to 200 gal. per day per sq. ft. With a 4% sludge and a 10-lb. loading, 5.6 volumes of water can be added before reaching the 200-gal. overflow rate; with 15-lb. loading, 3.5 volumes can be added. Depths of 10 to 12 ft. will automatically provide adequate detention and storage volume. Each stage must, of course, be designed independently because the entire volume of sludge and wash water passes through each stage. Use of design values as described should result in an installation which will justify the claims made for this process.

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1. "Computing Coagulant Requirements in Sludge Conditioning," A. L. Genter, *Trans. A S C E*, Vol 111, 1946, Pg 635.
2. "Elutriating Experiences at the Bay Park Sewage Treatment Plant," Anton E. Sparr, *Sewage and Industrial Wastes*, 1954, Pg 1443.
3. "Sludge Conditioning at Hyperion (Los Angeles)," Bargman et.al. *Sewage and Industrial Wastes*, 1958, Pg 1079.
4. "Operation Report Hartford, Conn. 1951-52," George E. Cramer, *Sewage and Industrial Wastes*, 1953, Pg 1356.

• • •

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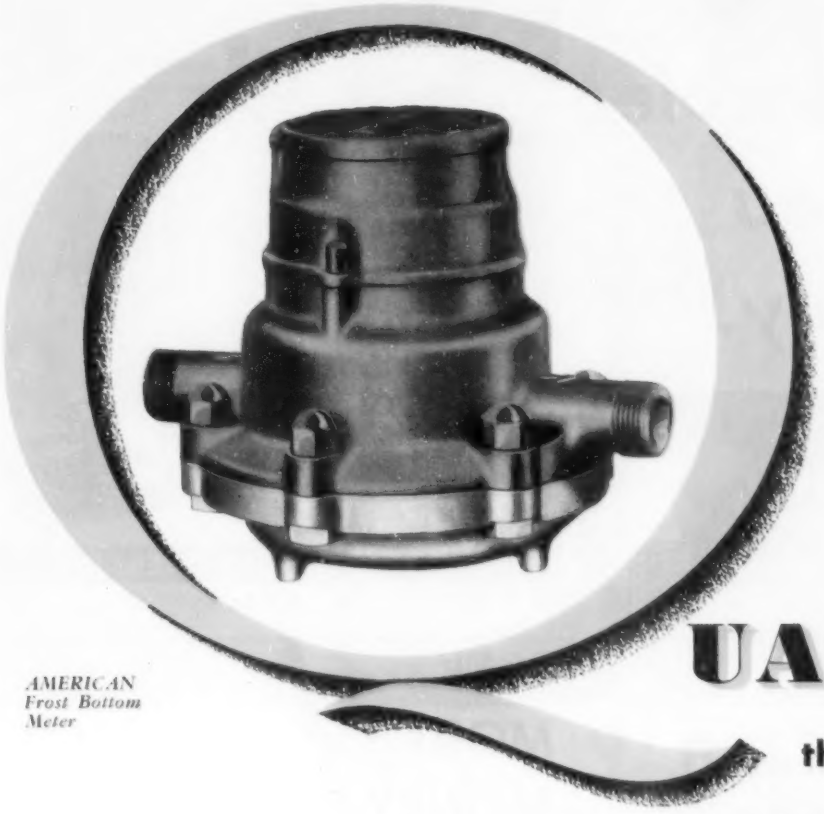

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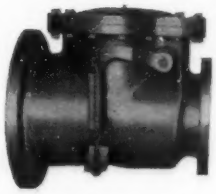

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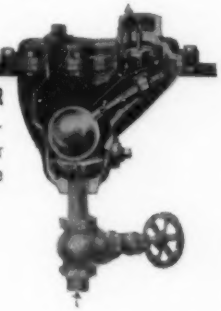

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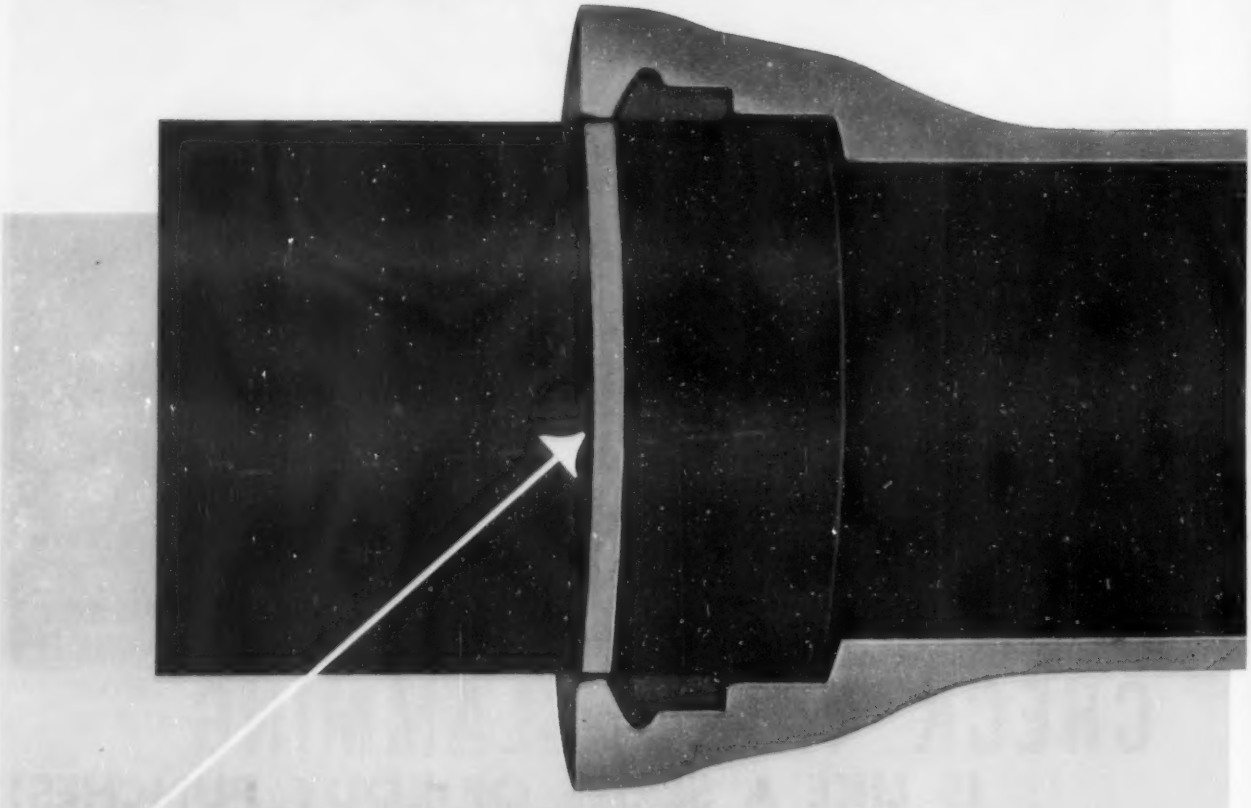

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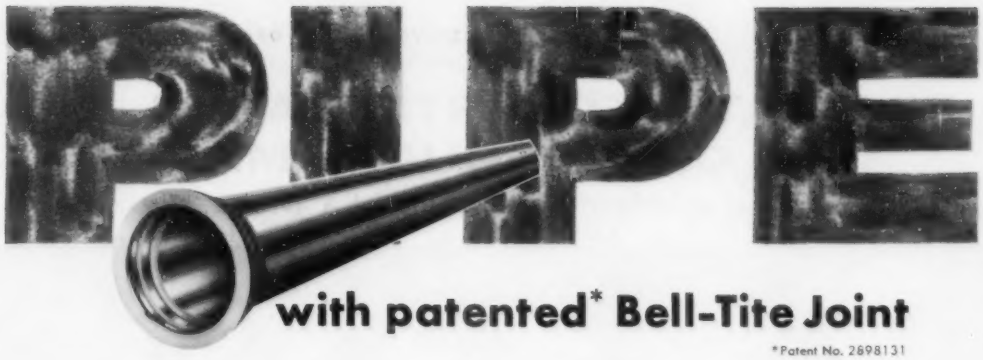

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Only one accessory is required to make a pressure-tight seal with a CLOW Bell-Tite Joint —a single, molded rubber gasket. There are no extras—no bolts, no nuts, no followers, no couplings. This economical pipe is strong, tough, uniform and durable for long-life underground service. It is available in any specified thickness or weight class in accordance with ASA, AWWA, or Federal specifications from 3″ to 24″.

Costs less to install

Assembly is quick, simple and easy. Pressure-tight joint is formed instantly by merely inserting the rubber gasket and pushing the pipe home to its seat. It can be installed in a wet trench and even under water. Rate of installation usually is limited only by speed of excavation. It permits ample deflection for casual curves or grades. Bell-Tite Joint pipe is Underwriters' Listed for working pressures up to 350 psi. Available in diameters up to 24″.

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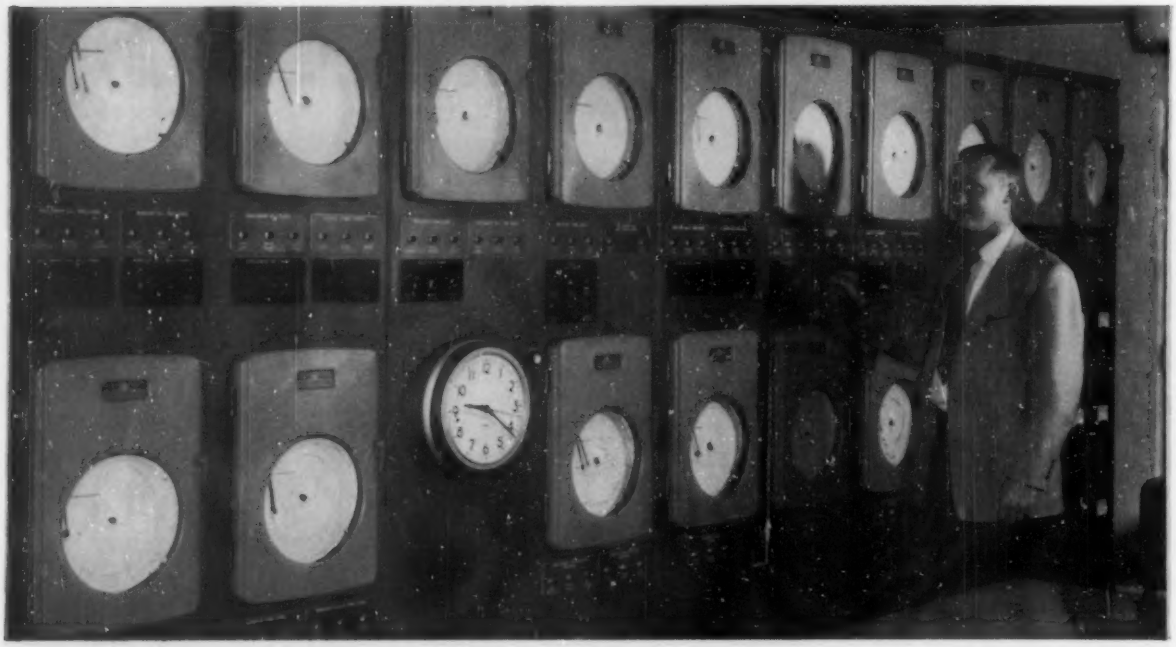

Bill Catlin, Helix Field Engineer, shows how one man can call the plays on operations at 40 remote locations scattered throughout the 49 square mile area. On this *one* panel, 28 levels, pressures, and flows are continuously and simultaneously recorded, 34 pumps can be automatically controlled (manual, on-the-spot control also provided) and valves can be opened and closed according to 4 remote valve-position indicators on panel.

B·I·F *Builders-Providence* **Synchro-Scan® Supervisory System Proves the Money-Saving Advantages of One-Man Supervisory Control!**

Concentrated on one central panel is all the information needed to call the plays that will save the taxpayers' money . . . through more efficient operation of this widespread system.

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For well over 30 years American Bitumuls & Asphalt Company has been closely associated with the roadbuilding industry. As leading marketers of asphalts, cut backs and emulsions, we will continue to deliver the highest quality products backed by the finest service available nationwide.

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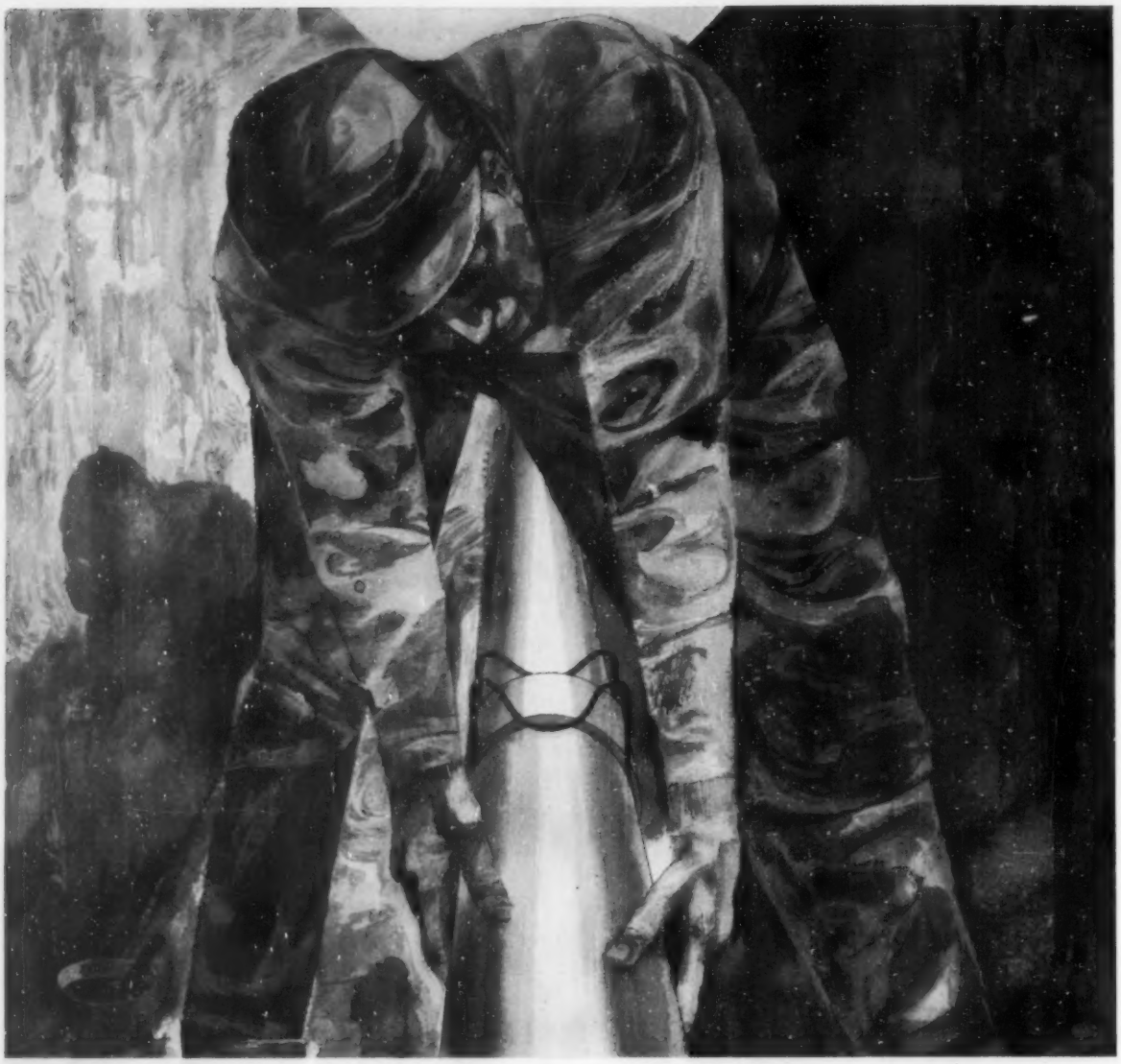

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Exclusive, patented FLUID-TITE Coupling connects in only two easy steps!

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What makes "K&M" Asbestos-Cement Pressure Pipe so special? Eighty-five years of asbestos engineering by one of America's pioneers in asbestos products. Put this wealth of experience to work for you. Write to us today.

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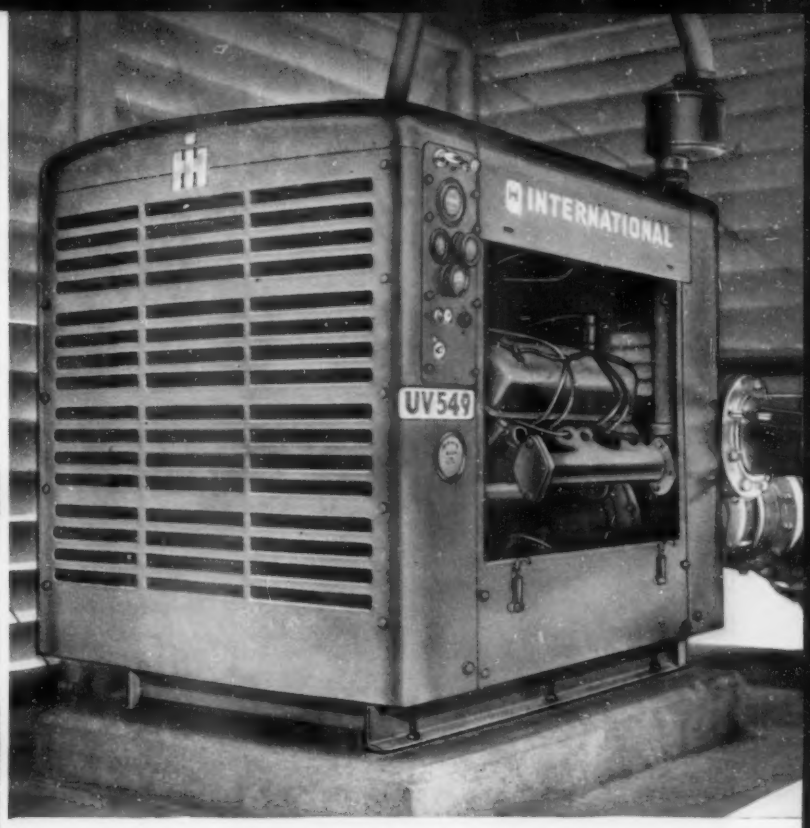

LOW COST INSURANCE against complete power failure is provided by this International UV-549-powered 8-in. standby pump on the water supply system for downtown Stockton, California.

How water supply for downtown Stockton gets dual protection for emergencies

The business section of Stockton, Calif., will receive water under adequate pressure in any emergency because of dual protection provided by the California Water Service Co.

Under normal conditions, the water company supplies water to 120,000 people of Stockton and vicinity from 51 pumping stations, each equipped with two to six wells. All wells pump into storage reservoirs and standpipe pressure tanks. Electric power comes from duplicating lines, so if one fails, a switch is made to the other line so that pumping continues.

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When your city needs dependable, low cost power for standby pumps, generator sets, or for repowering construction equipment, check your International Power Unit Distributor or Dealer. He sells power ranging from 16.5 to 385 max. hp in 32 carbureted and diesel models with one common feature—fastest payback power.

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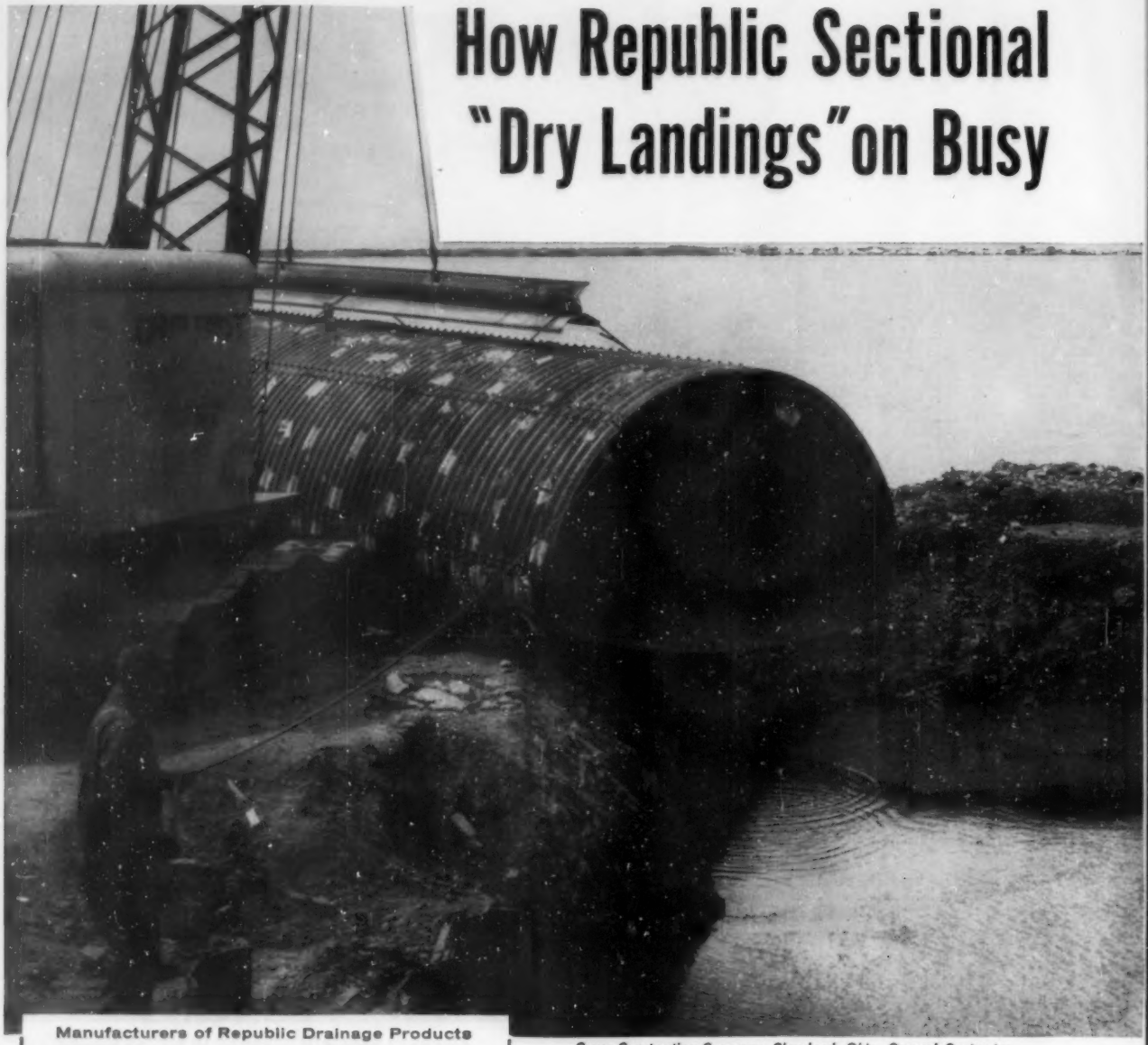
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

How Republic Sectional "Dry Landings" on Busy



Curro Construction Company, Cleveland, Ohio, General Contractor.

QUICKLY-ASSEMBLED elsewhere with special fasteners, this 44-foot asphalt-coated section is "ready for the plunge."

EASILY LIFTED by crane, 20-ton section of Republic Pipe-Arch is hoisted over brink into waiting drainage ditch.

LOWERED INTO PLACE this section is ready to be fastened to its neighbor. Joining under water creates no serious problem.

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Carolina Culvert & Metal Div. Florida Steel Corp.
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Central Culvert Corporation
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Dominion Culvert & Metal Corp.
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Eaton Metal Products Company
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Empire State Culvert Corp.
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Garland Steel Co.
Phoenix, Ariz.

Illinois Corrugated Culvert Co.
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Jensen Bridge & Supply Company
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H. V. Johnston Culvert Co.
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Logansport Metal Culvert Co.
Logansport, Ind.

M & M Hiway Materials Co.
Columbia, Mo.

North Dakota Metal Culvert Co.
Fargo, N. D.

Northeastern Culvert Corp.
Westminster Station, Vermont

Pacific Corrugated Culvert Co.
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Spokane Culvert & Fabricating Co.
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Tri-State Culvert & Mfg. Div. Florida Steel Corp.
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Wyatt Metal & Boiler Works
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Plate Pipe-Arch Aids Lakefront Airport

CLEVELAND, OHIO, ENGINEERS briefly furrowed their brows when they discovered an urgent need for additional drainage facilities in a sizable downtown area near the hub of the city. The obvious solution was to drain the area into the nearby waters of Lake Erie.

A COMPLICATION AROSE, however, in Cleveland's busy Lakefront Airport, sandwiched squarely between the lake and the area to be drained. Any feasible plan would have to be both economical and effective—and must also provide safety for the airfield, its hangars and other facilities, and its landing strips.

INTERVENING SOIL, between the drainage area and the lake, was found to be loose and unstable, necessitating an enclosure. But large-diameter, full-round pipe would require too much headroom. And a multiple installation of small pipe would be too costly.

THE SOLUTION WAS DISCOVERED in Republic Sectional Plate Pipe-Arch. In addition to its relative economy, the broad, flat base of Republic Pipe-Arch would permit the transmission of a greater volume of water at low heads than *round* pipe of equivalent size.

A CORRUGATED METAL DRAINAGE STRUCTURE 1850 feet long, with a rise of 7 feet, 11 inches, and a span of 12 feet, 6 inches was installed. It consisted of 5-gage corrugated Sectional Plate, asphalt-coated for long-lasting resistance to corrosion, and freedom from cracking, crumbling, or spalling.

SEVERAL LATERAL TIE-INS, running east and west across the airport, provided extra assurance of "dry landings" at all times. Moreover, it was found that the structure could handle drainage from as far south as Cleveland's Euclid Avenue—an artery bordering the principal downtown area of the city.

CLEVELAND'S EXPERIENCE is representative of the effective way Republic Sectional Plate Pipe-Arch can help solve many perplexing drainage problems. You'll find it well worth while to investigate these possibilities thoroughly. For further details, contact the Republic Drainage Products Manufacturer nearest you (see listing, lower left), or mail coupon.

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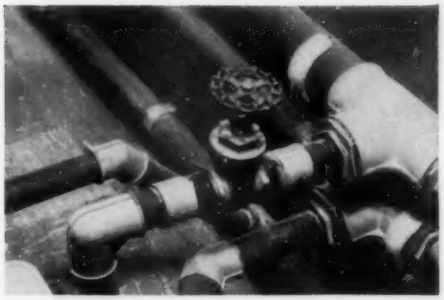

LIGHTWEIGHT REPUBLIC SRK PLASTIC PIPE resists highly corrosive chemicals, prevents scale build-up, yet costs no more than ordinary pipe. SRK is easy to handle and install . . . even in tight or limited space. Send coupon for information.

REPUBLIC HIGH STRENGTH BOLTS provide a vise-like clamping force that transfers loads to the structural members themselves. Fatigue life is improved to the point where it need no longer be a design consideration. For details, mail coupon.

REPUBLIC ELECTRUNITE® GROOVED-END TUBING offers cost-saving, time-saving advantages in many mining applications. Ideal for air, water, drainage lines, for tunneling and other heavy duty operations. Send coupon for details.

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Heavy jobs like this are easy for the big new Cat No. 14 Motor Grader, working here on a section of Interstate Highway System near Corsicana, Texas. Owner: T. L. James & Co. Inc. and R. W. McKinney, Corsicana.

MOST VERSATILE BIG GRADER EVER DEVELOPED

—NEW 150 HP CAT TURBOCHARGED NO. 14!

The first and only Turbocharged Motor Grader, the big No. 14 delivers high production at low operating cost both on the roughest and finest grading work. It packs 150 HP and 29,280 lb. heft to handle heavy work quickly. Operates at the highest practical working speeds with either a 12-ft. or 14-ft. moldboard. You don't have to pick "spots" to make it pay off. You can use it profitably on many different applications such as:

—**power applications** like heavy grading, ditching, rough grading, bank sloping. Its low center of gravity provides extra blading and machine stability.

—**control applications** like light spreading, surface maintenance, fine grading and light blading. With Preco Automatic Blade Control, it controls blade slope within ⅛ in. in 10 ft.—cuts fine grading time in half.

Some of its many new features are shown here. All these and time-tested features combine to give you maximum return on every tax dollar invested. And remember, trade-in value on Cat machines is tops. For the complete story on the big, versatile No. 14, see your Caterpillar Dealer. Ask for a demonstration!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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BORN OF RESEARCH
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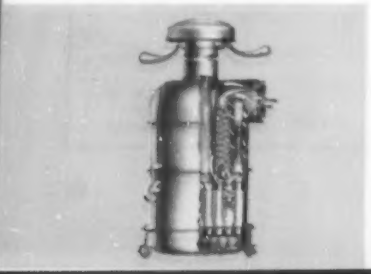
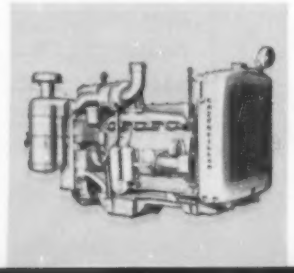
PAYOFF FEATURES OF THE NEW NO. 14 — Plus exclusive oil clutch, power steering and power brakes, tubeless tires, extra strength frame, unequaled visibility and many other features.

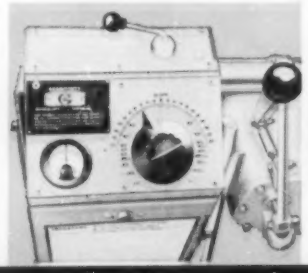
NEW DRY-TYPE AIR CLEANER. Removes 99.8% of all dirt from intake air during **every** service hour. Can be serviced in 5 minutes. Cuts maintenance time by up to 70%. Extends engine life.



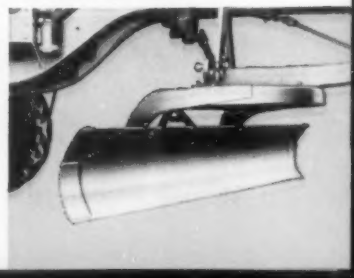
NEW TURBOCHARGED CAT ENGINE. Turbocharger utilizes waste energy from engine exhaust to increase efficiency and economy. Engine provides high torque rise that pays off on the job.



PRECO AUTOMATIC BLADE CONTROL. Optional. Operator selects desired slope on dial. Now transistorized, unit automatically controls blade slope within ⅛ in. in 10 ft.



HIGH THROAT CLEARANCE. New design permits increased clearance between moldboard and circle for greater loads. Also extra-strong frame, circle and drawbar.



PUBLIC WORKS MAGAZINE
Volume 90, Number 9 SEPTEMBER 1959

MUNICIPAL PARKING—
OPERATION AND DESIGN STANDARDS

CARLTON F. HARTMAN,
Principal Engineer,
Bureau of Engineering,
White Plains, New York

A CHANGE took place in White Plains, New York, shortly after the end of World War II that permanently altered the physical face and economic character of the city. The phenomenon known as the rush to the suburbs began. Between 1945 and 1957 the population jumped 25 percent, to 50,000. White Plains, the county seat of Westchester County, became the center of a trade area with an estimated shopping population of 300,000.

Shortly after the rush began it became apparent to city officials that something would have to be done immediately to cope with the double-barrelled problem of providing adequate parking facilities for both shoppers and the commuters who worked in New York City. Although the City installed its first street meters in 1938, and opened what is believed to be one of the first metered off-street parking lots in New York State in 1946, it was felt that a critical problem required drastic action. As a result, the New York State Legislature created the White Plains Parking Authority in 1947, and it has been a going concern ever since.

The Parking Authority has as its credo, "Parking space is an economic necessity for a municipality —not a luxury." It regards parking meters not as coin-catchers, but as devices to control parking. The Authority consists of five persons appointed by the Mayor and they serve without compensation.

The Authority has the following powers:

1) To acquire land by purchase, lease or condemnation;

2) To construct and operate off-street parking lots;

3) To rent lots to concessionaires;

4) To issue bonds up to a limit of $2,000,000;

5) To pledge parking revenues for bond redemption; and

6) To contract with the city for various services.

In the 12 years the Authority has been in existence it has never issued a long term bond. Instead, it has financed its parking lot development program from earnings and through the sale of short term capital notes. The maximum period of time for which a short term capital note can be issued is five years, payable at the rate of 20 percent of the gross amount per year. During this 12-year period several of the lots have paid for themselves. One lot has earned more than three times its original cost.

At the present time the Authority operates 22 parking lots, with capacities ranging from 32 to 283 parking spaces. Depending upon the need they fill and other factors, they are either metered (19) or leased to concessionaires at public auction (3). The development of two additional lots to provide approximately 470 parking spaces for commuters is now under study.

The Authority installs, maintains and receives the total receipts from all of the parking meters in the city, i.e., 2071 in parking lots and 1478 on streets. Including the 700 parking spaces in parking lots leased to concessionaires, the Authority provides a total of 4249 spaces.

● SHOWN here are a coin changer, sign showing rate and time limit, mercury vapor lighting and double parking meters.

● TYPICAL installation of bumper post, with bumper rail, bituminous curb, coin changing machine and snow storage area.

Although the White Plains Parking Authority provides all of the municipally-owned parking spaces in the city, approximately 6000 other public parking spaces are available in privately-owned parking lots. The total of approximately 10,000 parking spaces provides one public parking space for each five residents of the City of White Plains, which is considered to be above the national average.

Rates for metered parking range from five cents per half hour to twenty-five cents for all-night parking. Gross parking revenues for 1958 were: Meters in parking lots, $208,725.55; meters on streets, $131,-186.70; and parking lot rentals, $45,-258.15. This was a total of $385,170.40 for the year.

Principal expenditures during 1958 were for administration, equipment and supplies, maintenance, lighting, land rental, taxes and contributions to the city for services, i.e., policing, snow removal, etc.

The Bureau of Engineering of the Department of Public Works is responsible for the design and construction of all parking lots developed by the Authority. Through the years a set of standards has been adopted by the Bureau which can be modified to meet almost any conceivable condition or requirement.

After the Authority has acquired the land that is to be developed into a parking lot, it requests the Bureau of Engineering to make a study of the parking layout.

Upon receiving approval of the parking layout from the Authority, the project is assigned to an office engineer who is responsible for the final design and all other necessary work through the assembling of contract documents and advertising for bids. After the contract has been awarded the project is assigned to a field party, who furnishes all engineering and inspection necessary for the construction of the parking lot. In addition, a private testing laboratory is retained to test certain materials used in the job, i.e., blacktop, concrete, pipe, etc.

Since almost all of the lands acquired by the Authority contain buildings that must be demolished, a set of detailed specifications has been developed for this purpose. They contain provisions for the following:

1) Removal of the superstructure;

2) Breaking up the cellar floor so as to prevent collection of water (and subsequent soft spots in the pavement);

3) Removal of the foundation walls to a point three feet below finished grade;

4) Backfilling the cellar with properly compacted clean fill;

5) Sealing the sanitary sewer at the property line;

6) Shutting off the water service line at the main;

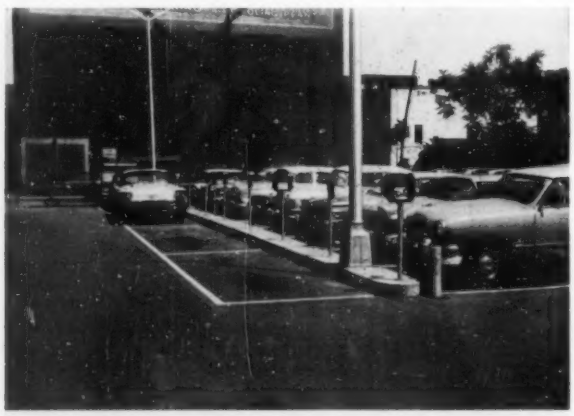
7) Removal of and/or sealing all other service lines, fuel oil tanks, etc.; and

8) Removal of all debris.

Lay-Out

Since the shape and dimensions of each parcel of land that is to be developed into a parking lot is fixed, and varies widely from each previously developed parcel, creative ability upon the part of the design-

● THIS picture shows the layout of one of the newer lots, the Wall Street lot, with directional lines and parking meters.



● RAISED concrete island, with bumper rail, mercury vapor lights and parking meters for parallel and head-on parking.

ing engineer is highly desirable. He is faced with the problem of providing the greatest number of parking spaces possible at the same time he gives up parking spaces to facilitate safe vehicle movement through the lot. In order to provide a balance between these two requirements, the Bureau has adopted the following standards:

1) *Perpendicular Parking.* Stall width 8.5 ft., stall length 18 ft. and aisle width 25 ft.

2) *Angular Parking.* Stall width 8.5 ft., stall length 18 ft. and aisle width varies, depending upon angle.

3) *Parallel Parking.* Stall width 7 ft. and stall length 18 ft. with end access and 22 ft. without end access.

If possible, separate entrances and exits to and from the parking lot are provided as far as possible from busy intersections. Where the entrances and exits cannot be separated, an extra-wide driveway apron or one separated by a raised island between the entrance and exit lanes is provided. If the entrance or exit is located on a busy street, curb returns with longer radii or with elliptical radii are provided to facilitate traffic flow between the street and the lot.

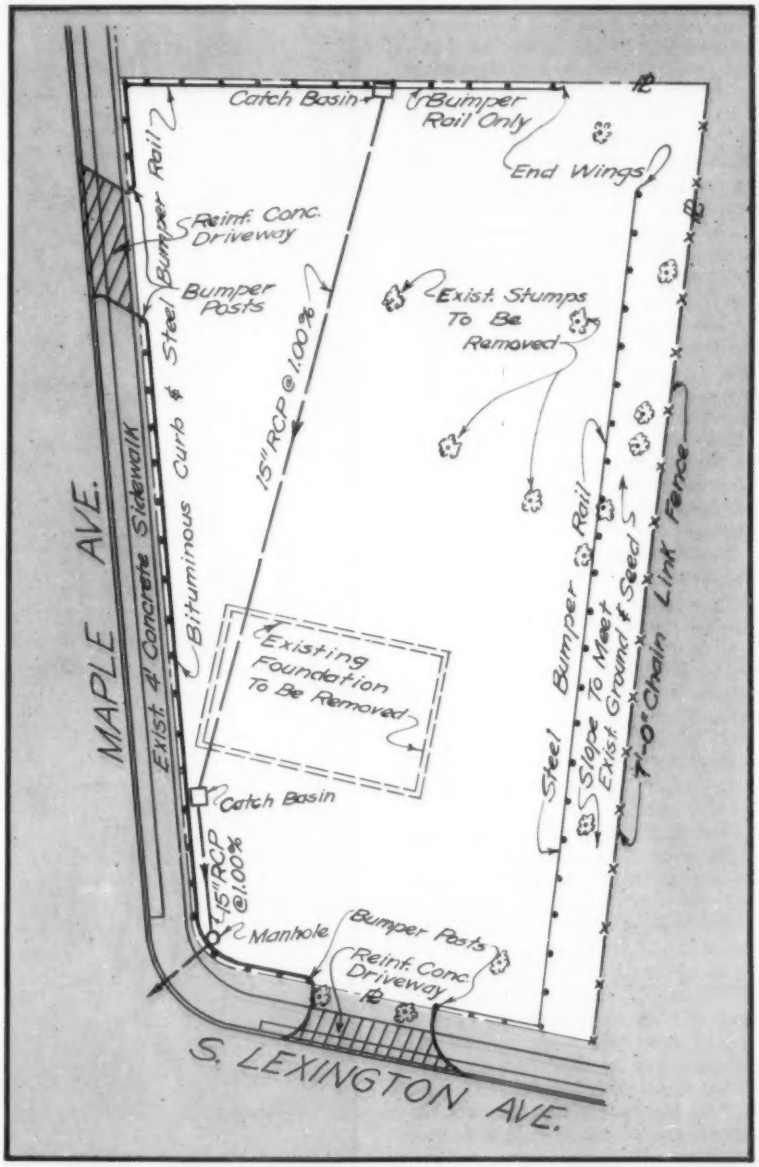
Almost every parking lot contains so-called "left over" or "wasted" areas that cannot be used for either parking space or to facilitate traffic flow through the lot. In some communities these areas are landscaped and thus add something to the appearance of the lot. In White Plains they are paved. Experience has shown that the first cost and subsequent maintenance costs are thus minimized. In addition, these areas are useful in providing snow storage space. Because these areas are available for snow storage, the capacity of the lot is not materially reduced during the snow removal operations after a snowstorm.

Drainage and Pavement

A well-designed drainage system is as important as a proper lay-out in contributing to the success of a parking lot. Nothing is quite so discouraging to shoppers as being forced to wade through pools of standing water after each rain storm. Nothing will bring complaints faster and damage public relations more than accidents and near-accidents caused by icy conditions in the winter. Nothing will break a maintenance superintendent's heart faster than to stand helplessly by as surface water trickles into the pavement base and subgrade, and the pavement is pulverized by frost heave and traffic loads.

The drainage standards adopted and used by the Bureau of Engineering in the design of parking lots have proven themselves time and again in reducing to a bare minimum the time required to drain a parking lot after a rain storm, and in minimizing the effects of snow, ice and sudden thaws.

Underground drainage systems in all parking lots are designed to carry the run-off from a storm that is likely to occur once in 10 years. In the White Plains area 10-year storms have a design intensity of 2 inches per hour. The rational formula is used for design. Sizes and slopes of drain lines are based upon a minimum velocity equal to a self-cleansing velocity of 2½ feet per second, and a maximum velocity equal to a scouring velocity of 8 feet per second. In order to prevent stoppages caused by the entrance of foreign objects into the drains, the minimum size pipe used for all drain lines and catch basin leads is 12 inches in diameter. Reinforced concrete pipe is used for all drain lines and catch basin leads. Manholes are built at each change in direction, change in slope and at all points where catch basin leads connect to the drain lines. Most drain lines are



● **LAYOUT of this typical parking lot shows the first stages in its development. This includes clearing, drainage, fencing, driveways and installation of barriers.**

relatively shallow, with the minimum cover from finished pavement grade to the top of pipe being three feet.

Since most of the catch basins are built in the paved areas, the inlet gratings are flat and no benefit is received from the curb inlets found on top of the standard street catch basin. As a result, the inlet gratings are designed to provide ready passage for water, leaves, papers and other materials that would ordinarily enter standard street catch basins through their curb inlets. Ready passage of debris of this type is essential if inlet stoppages that result in ponding and icing conditions are to be prevented. Most catch basins in parking lots contain sumps to provide storage for sand, grit and other heavy inorganic debris.

The subject of drainage would not be complete without a few words about the design of pavements with regard to drainage. Experience has shown that it is extremely difficult to place a blacktop pavement to a grade less than one percent without developing some shallow "duck ponds" in it. This has resulted in the adoption of a one percent slope as the minimum acceptable for pavement surfaces. At the other extreme is the slope at which comfort in driving and parking begins to decline. Here, too, experience has shown that the desirable maximum slope of pavement surfaces is three percent, and the absolute maximum slope is four percent.

The following prices are recent bid prices for the installation of various items of storm drainage systems. It must be kept in mind that the prices quoted for items of work in the following paragraphs of this article are set forth in terms of price ranges. Actual bid prices for each project are dependent upon such factors as the size of the job, accessibility of site, complexity of construction, etc.

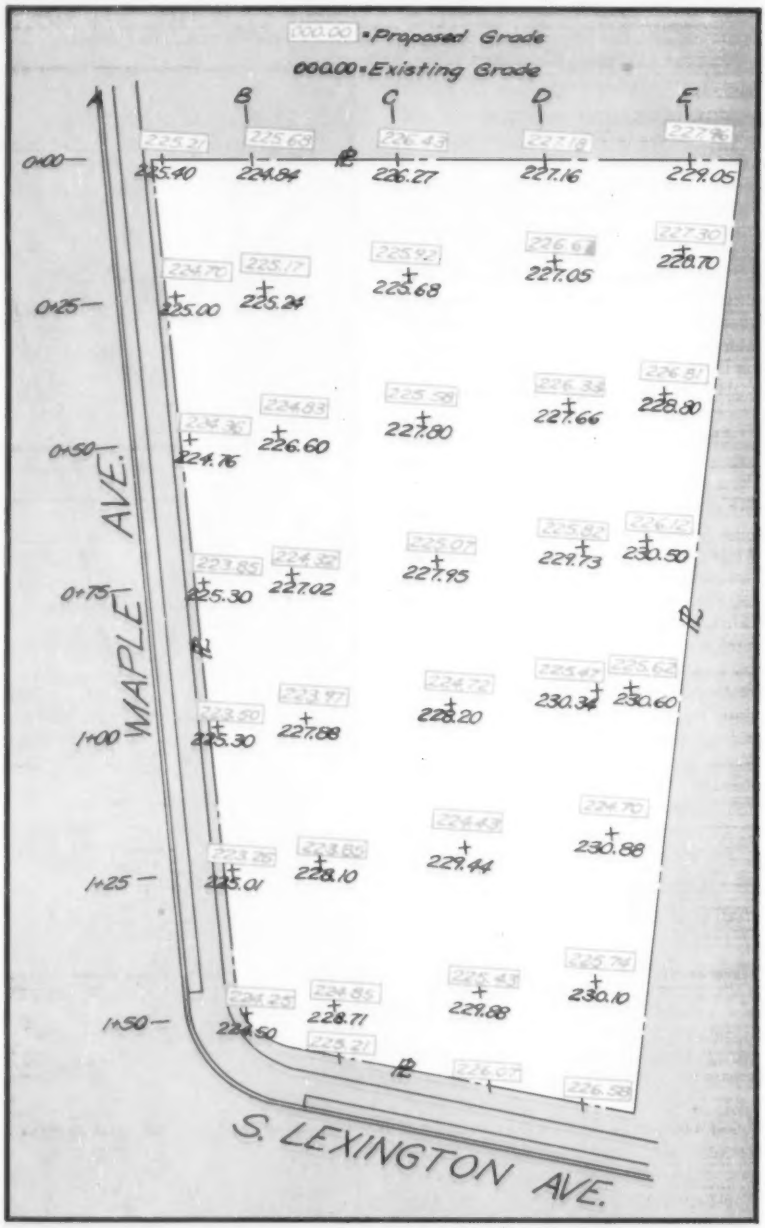
Cost of storm drainage items are as follows: 12-in. reinforced concrete pipe range from $5.00 to $8.00/l.f.; 15-in. reinforced concrete pipe from $5.25 to $10.00/l.f.; broken stone for underdrainage from $6.50 to $10.00/c.y.; catch basins from $270.00 to $350.00/ea.; and manholes from $340.00 to $400.00/ea.

All excavated material remains the property of the City of White Plains and is deposited by the contractor in such places as the Engineer may direct. This specification has proved its worth many times over in that it provides a means for economically filling areas where other projects are to be built in the future. This practice often allows the fill thus obtained to settle naturally during the year or two that passes before the planned project is actually built. When fresh fill is supplied by the contractor for the construction of a parking lot, he is required to compact it in 12-inch layers. Upon obtaining a satisfactory degree of compaction, fine grading operations are begun.

Recent bid prices for excavation and fill items are: Unclassified excavation, $0.50 to $3.50/c.y.; additional earth excavation, $5.00 to $6.00/c.y.; rock excavation in trench, $8.00 to $15.00/c.y.; run-or-bank gravel, $3.00 to $4.00/c.y.; and fill, $2.00 to $2.75/c.y.

A standard pavement is now used in the construction of all parking lots. It was selected because experience proved it to have achieved a better balance between the factors of low first cost, long useful life and low maintenance costs than any of the other pavements used in the past.

The asphaltic macadam base of the standard pavement is constructed of 1½-in. crushed traprock. The



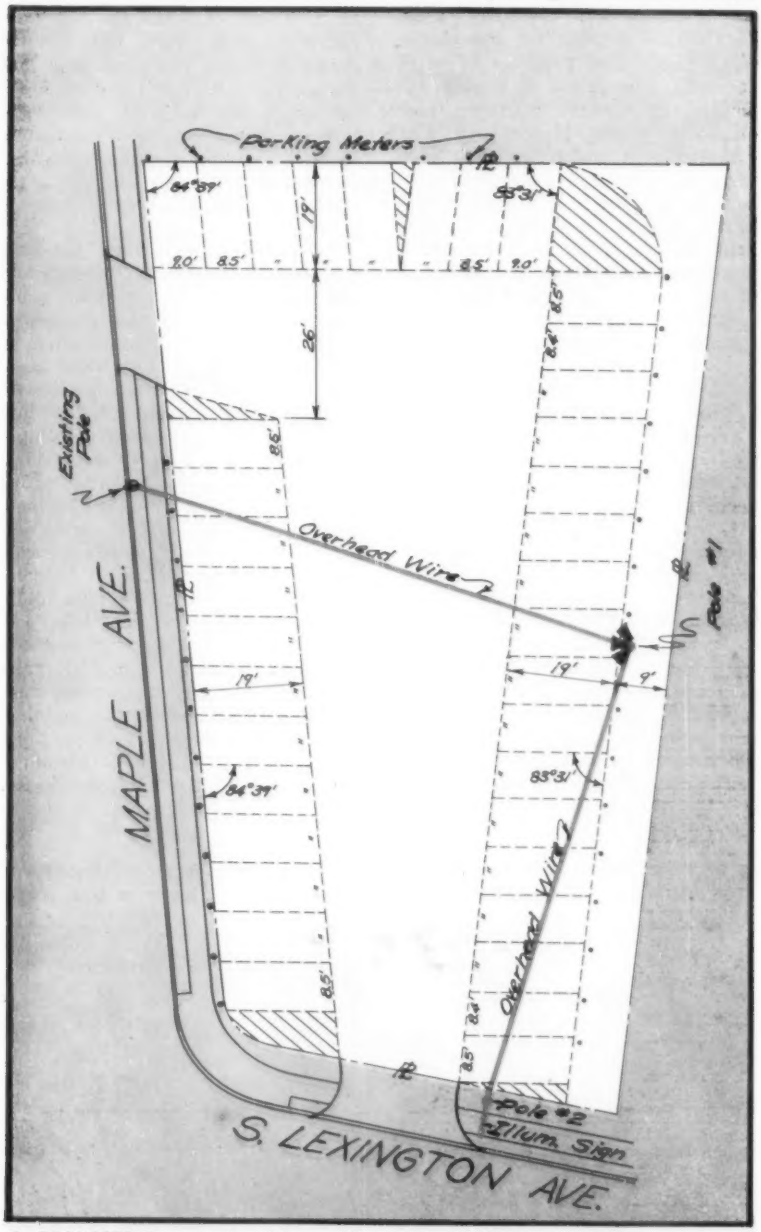
● **GRID SYSTEM** such as this is used to establish finished grades for pavement. Grades held between 1 and 3 percent will eliminate puddles and make parking easy.

traprock is spread and rolled with a ten-ton roller until the stone is satisfactorily compacted into a layer four inches in depth. The stone base is then penetrated with an 85-100 penetration asphaltic oil whose temperature, when applied, is between 275°F and 350°F. The oil is applied with a pressure distributor at the rate of two gallons per square yard. The asphaltic macadam base is then keyed by spreading a thin layer of $\frac{5}{8}$ to $\frac{3}{4}$-in. crushed traprock over the surface and rolling it into the still-hot asphalt with a ten-ton roller.

In the final step of the pavement construction, a layer of bituminous surfacing material is placed on top of the completed asphaltic macadam base. To insure uniformity of depth, it is laid with a paving machine. The surfacing material is then rolled with a ten-ton roller until it is satisfactorily compacted into a layer two inches in depth. Traffic is kept off the fresh pavement for several hours after it has been completed in order to eliminate all chances of rutting.

A concrete driveway apron is constructed between the street curb and the parking lot at all entrances to, and exits from, the parking lot. The apron is a seven-inch layer of 1:2:3½ concrete placed directly upon the subgrade. It is reinforced with ⅜-in. diameter deformed steel bars 12 inches on centers both ways. A 1½-in. lip curb at the street gutter provides for the passage of storm water past the driveway.

Recent bid prices for pavement items are: 4-in. bituminous macadam base, $1.80 to $2.20/s.y; hot-mix bituminous surfacing material, $13.00 to $14.00/ton; and reinforced concrete driveway apron, $10.00 to $12.40/s.y.



● **PROPOSED layout of parking stalls, meter positions, snow storage areas and lighting. Design aims for maximum capacity within limits of safe vehicle movement.**

Traffic Controlling Devices

A wide variety of traffic controlling devices are available for use. The ones actually used are selected as being those best suited to fulfill the needs of the individual parking lot. These needs are determined by making a study of the lay-out of the parking stalls, traffic flow patterns and uses made of various areas within the lot; special requirements; first costs; maintenance costs and esthetics. In addition to controlling traffic, these devices also protect pedestrians, automobiles and meter installations.

The traffic controlling device most commonly used is the steel bumper rail. Wooden bumper rails were used in the construction of a few of the earlier parking lots; but experience has since proven them to be unsatisfactory. Although their first cost is moderate, their useful life is relatively short and maintenance costs are high. The wooden planks have a tendency to splinter or break rather easily when struck by an automobile, and are subject to rot from exposure to the weather. In order to preserve a neat appearance in the parking lot and to maintain a high degree of usefulness, it was necessary to replace broken planks and paint those that were structurally sound rather frequently.

The steel bumper rails now used are made of #10 gage steel, measure 12 inches from top to bottom and have a double-ribbed face. They are bolted to three-inch diameter steel pipe posts driven three feet into the ground on 6-ft. 3-in. centers. The rails are mounted so that their tops are two feet above the surface of the pavement. After the installation has been completed, both bumper rails and posts are given two coats of aluminum paint.

Another traffic controlling device that is sometimes used is the bumper post, or its variation that contains a parking meter installation, the

(*Continued on page 158*)

Infiltration 91 percent Below Allowable

LIKE MANY other fast-growing American communities, Vero Beach, Florida was faced with the problem of providing adequate municipal sewerage facilities for a rapidly growing population. Attractively situated in the heart of the famous Indian River citrus country, the town has grown from a population of only 702 in 1908 to a current total of about 7,500. City officials estimate a permanent population of 25,600 by 1985.

With this rapid influx, the demands made on the city's sewerage system increased. A small system, built in 1925 served only a part of the downtown area; the balance of the town had been using septic tanks. In 1956, a project was initiated to provide Vero Beach with sewerage facilities. At the request of the City Council, two firms of consulting engineers—Gee & Jenson, West Palm Beach, and Lloyd & Associates, Vero Beach, prepared plans for the new facilities.

Engineering work had to contend with difficulties presented by the terrain. Topographically, Vero Beach and the adjacent countryside are very flat. Ground elevations range from sea level to about 20 to 22 ft. above sea level in the extreme western part of town. Soil types are variable, including sand, muck, marsh, hummock and pine land with underlying deeper rock formations.

Because of the extremely high water table, it was essential that the sewer system be as infiltration-proof as possible. All concerned in the planning recognized that the key to keeping infiltration down is making water tight joints in sewers. After exhaustive testing, Dickey vitrified clay pipe with flexible compression type couplings was selected. This joint forms a tight, yet flexible joint that practically eliminates infiltration.

Plans called for construction of a $750,000 treatment plant, and installation of over 164,000 feet of 6-inch to 12-inch diameter pipe.

The Edelblut Construction Company of Fort Myers, Florida, started building the $2,100,000 collection system in April, 1958. Shortly after this, ground was broken by Richardson Construction Company, Fort Lauderdale, Florida for the treatment plant. The progress of construction was followed closely by Eugene Lyon, City Manager, and James W. Young, Mayor.

Speed with which the pipe was installed surprised observers. According to Chuck Williams, Edelblut's project superintendent, who kept accurate records of the man-hours involved in the job, the last of the 22 miles of new sewers was completed in October, 1958. "Our records show that an average of two work crews of eight men each were on the job daily," Mr. Williams said. "These crews laid an average of 1,244 ft. of pipe in an eight-hour day. That makes a total of 27,383 ft. per month, complete and ready for use. In addition crews dug ditches, set well points (in some places, double points), back filled, tamped and ran infiltration tests.

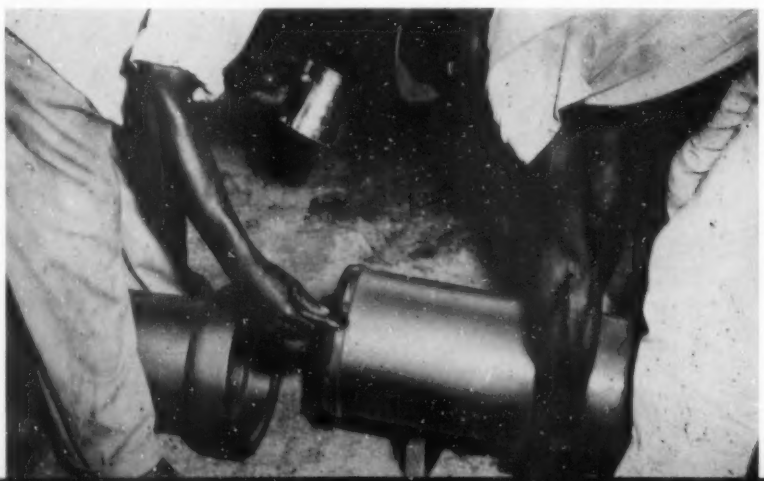
As an example of this high rate of production, Mr. Williams referred to records kept during one day to cover the time required for an eight-man crew to build 1000 ft. of new sewers. The time check began the minute the backhoe started to open the trench and concluded when the last bucket of back fill was in place and the line tested.

"The entire job took only eight hours," Mr. Williams said. "We consider that record time."

Infiltration tests prove the wisdom of selecting this new type of coupling. Despite the fact that almost 60 percent of the pipe was laid below the water table, tests proved that infiltration averaged only 500 gallons per mile per day. This is 91 percent below the 6,000 gallon allowance. These tests were conducted under direction of John Charles, Gee & Jenson resident engineer, and Robert F. Lloyd, Lloyd & Associates.

According to Mr. Lloyd, building the new sewers with this Dickey coupling pipe has provided two substantial savings for the taxpayers of Vero Beach. Since infiltration is kept to a minimum, less water goes through the treatment plant. "Keeping infiltration down means that the cost of operating the sixteen pumping stations and the treatment plant is held to an all-time low," Mr. Lloyd said. "This means big savings for the future as well," he continued. The size of the treatment plant was based on a sewage flow of 100 gallons per day per capita plus infiltration of about 6,000 gallons per mile per day. But, since infiltration has been reduced to only 500 gallons, the new treatment plant can accommodate a substantial population increase without expansion. This represents excellent planning and provides substantial savings to Vero Beach taxpayers.

● **BECAUSE most of the Vero Beach sewers had to be laid below ground water level, tight joints were essential. Below, workmen apply lubricant sealer to pipe joints.**



CEMENTING WATER WELLS

BOB DIGGS BROWN,
Assistant Division Manager and Division Engineer,
Halliburton Oil Well Cement Company, Houston, Texas

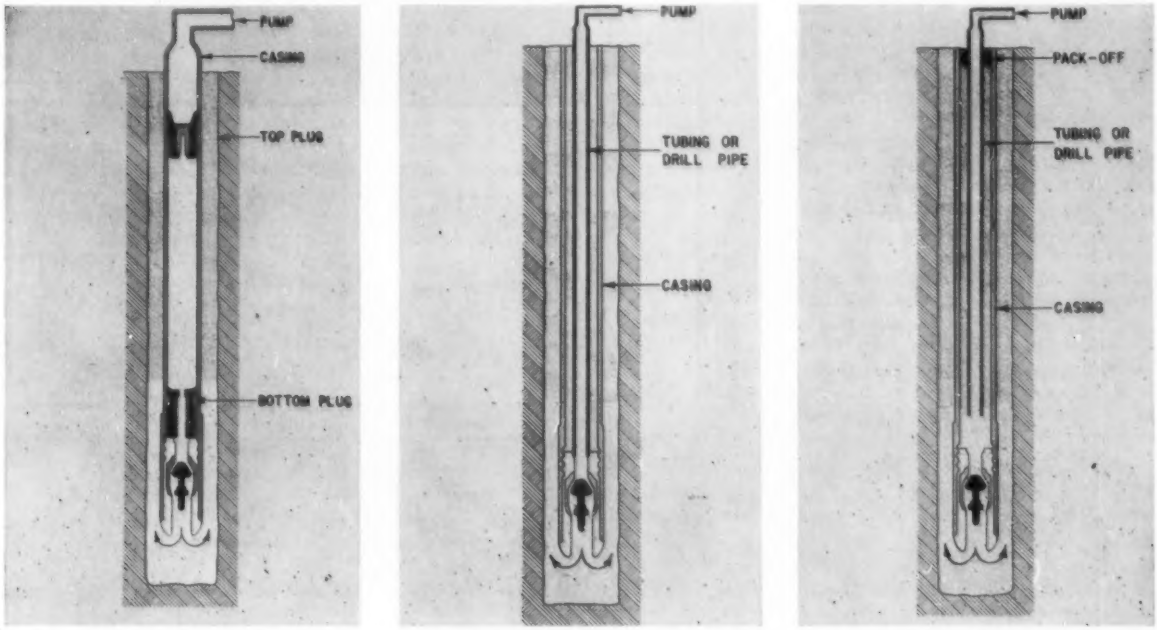
THE CHALLENGE of producing more water with a greater emphasis on conservation must be met by individuals, industry, municipalities, engineers, contractors and service companies. The program selected by the well owner for individual wells must be based upon geological data obtained from surface and sub-surface data such as cores, cuttings, and electrical logs; evaluations of the aquifer for desirability and productivity; isolation of zones for water production; and stimulating maximum productivity.

This article discusses techniques and materials which will aid in obtaining maximum control of isolating the producing zone or zones. Isolation is desirable to protect the producing water-bearing formation from contamination from less desirable strata or from the surface.

The use of cementitious materials will provide the most effective means of effecting this isolation, will permit techniques of stimulations requiring hydraulic pressure and fluids and will help to protect casing against corrosive waters. Today the types of materials used to cement casings are many, permitting dry blending of several additives to meet specific well conditions. One water well contractor in reviewing wells completed in Texas found that 65 percent of those 200 to 1200 ft. deep, 30 percent of those 1200 to 2000 ft. deep, and 5 percent of all those of greater depth, had cemented casings. His data indicate 95 percent of the wells will be less than 2000 ft.; therefore, the cementitious material discussed herein will be compatible to that range.

Portland cement used for cementing generally is Type I, as used in general concrete construction. To date this material has been most widely used in the water well industry since availability is not dependent upon other industries such as petroleum.

Bentonite is a colloidal clay which requires a large volume of water. When it is added to cement in quantities varying from one to eight percent, a slurry lighter than the neat cement will result with an increased yield depending upon the percent of Bentonite. The addition of Bentonite will generally reduce the compressive strength of the material as compared to neat slurry.



● **TECHNIQUES of cementing wells: Left, two plug system; center, plunger type receptacle; and right, continuous method.**

Pozzolans are silicious materials which in themselves possess no cementitious value but which, in a finely divided form will, in the presence of water, react chemically with lime at ordinary temperatures to form compounds that have cementitious properties. These pozzolans, when used with Portland cement, react with the free lime liberated from cement and thus become cementitious. Properties of such materials are lighter slurries, highly resistant to sulphate and

salt water, low permeability of set material and low expansion upon setting.

Perlite is a volcanic material which is mined, screened and expanded by heat to form a cellular product of extremely low weight. Portland cement with a small amount of Bentonite (2 to 6 percent) helps to prevent segregation of the Perlite particle from the cement slurry, reduces slurry density, increases yield of material and acts as a bridging material for porous or fractured formations encountered while cementing.

A special graded diatomaceous earth is added to Portland cement, varying from 10 to 40 percent by weight, to permit formulation of low density material.

Gilsonite is a selected and graded asphaltite having a specific gravity of 1.07 which will neither accelerate nor retard the setting time of the cement. Gilsonite is impervious to corrosion by waters or brines and resists the attack of acids or alkalies. Slurries containing Gilsonite are compatible for zones requiring low hydrostatic pressure, bridging aids and maximum compressive strengths for minimum densities.

There are various accepted minimum compressive strengths for a cementitious material; however, the most popular minimum is 500 psi.

The economic factors must be considered by the well operator in planning the well completion program. In instances, special materials are required to fulfill certain specifications which preclude cost considerations. The majority of the wells will permit a wide selection of cementitious materials which can result in an economic advantage.

Cementing Operation

One problem which may arise during the cementing operation is that of mud contamination. An excellent procedure for minimizing mud contamination is the two-plug system. This operation consists of a special container for the plugs which is an integral part of the casing. Drilling or circulating fluids may be pumped through this container until mixing of cementitious material begins. At this time the bottom plug is released and is pumped ahead of the slurry, fulfilling two functions: 1) providing a barrier between the slurry and drilling fluid and 2) cleansing the casing wall of drilling mud. When this plug reaches the float collar the differential pressure ruptures the diaphragm at the top of the plug and allows the cement slurry to proceed through the plug and floating equipment and up the annular space behind the casing.

Upon completion of the mixing operation, the top plug is released from the container. This plug is so designed that when it is displaced to the bottom it will seat effectively on the bottom plug, resulting in a pressure build up. The two plug system requires knowledge of formations by the well operator since correct wash-out factors must be used to provide proper fill up or circulation of slurries.

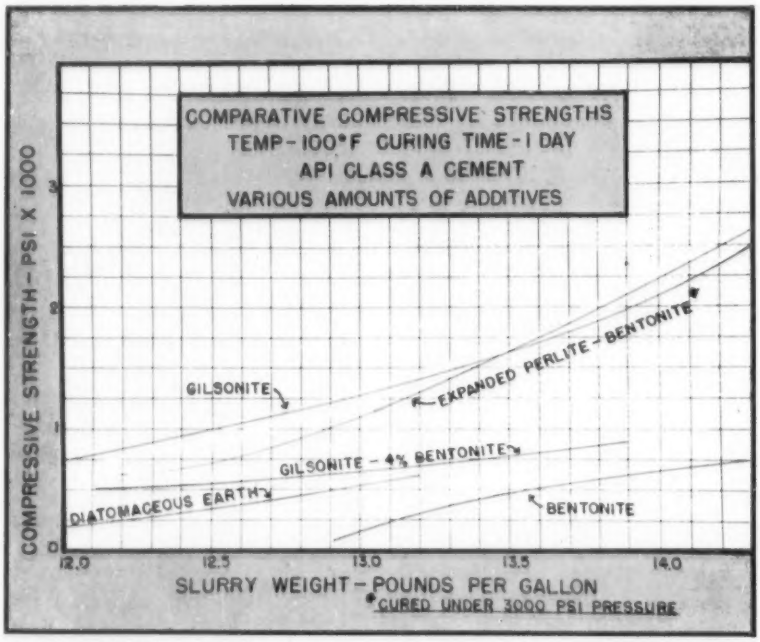
There are instances where circulation is a necessity but information is lacking as to wash-out factor. In order to minimize contamination, the continuous method is used effectively. The continuous system involves running tubing or drill pipe to the proximity of the float shoe or collar with a sealing element between the tubing or drill pipe and casing. Cementitious materials can be mixed until such time as returns are noted on the surface.

The plunger type receptacle is an improved technique of the continuous system involving a special type of floating equipment designed with the receptacle to seat an adapter attached to the tubing or drill pipe. This system minimizes contamination and provides the advantage of continuous mixing.

The continuous system is a very practical approach to the cementing of casing sizes 16-in. and above since a two-plug system in many instances would require special plugs, plug containers or swages.

A new tool developed for the petroleum industry incorporates features which are compatible from an economic as well as operational standpoint for water well completions. In operation of this tool, the special plug is dropped from the surface and, through application of pump pressure, sets the sealing element and opens circulating ports. Cementitious material is mixed and pumped into the casing, through circulating ports and above the sealing element. The top cementing plug seats on a special sleeve and through application of pressure closes the circulating ports. Continued application of pressure shears the pins permitting plugs and sleeve to be pumped out of tool thereby eliminating the drilling-out operation.

A problem encountered in cementing large diameter casing to the surface is that of flotation. To counteract the flotation factor it is sometimes necessary to weight up or increase the density of the displacing fluids. This operation is expensive; however, with knowledge of the properties of various cementitious materials the cost can be minimized.



● **COMPRESSIVE strengths of various materials used for well cementing work.**

This article is based on a paper presented at the Texas Water and Sewage Works Associations' Short School, College Station, Texas, March, 1959.

Calcium Chloride FOR DUST CONTROL ON UNPAVED STREETS

TOM HENRY,

Director of Public Works,

Cherryville, North Carolina

SEVERAL years ago one of our streets that was to be paved was graded and 450 lbs. psy of crusher-run stone base was placed on it. The property owner wouldn't agree to paving, so the project was stopped at this point.

The street was maintained in the same manner as our other unpaved streets. Three years later, upon checking the stone base, it was found that over half of the base material had disappeared. The original 4½-in. base thickness was down to a 2-in. average thickness. Conservatively, the 67½ tons of stone lost cost $2.20 per ton and represented a $148.50 loss of materials alone. When we demonstrated to the Mayor and Board of Aldermen that the fines in the base were blowing away as dust and the coarse aggregate was being kicked to the side ditches by traffic and washed away by the rain, they were amazed to learn of this loss and equally amazed to know that we could avoid it by applying 1½ lbs. of calcium chloride psy in two applications during the summer to that 300-ft. block at a total cost of $25.33 per year. The three-year treatment would have cost $76 and would have saved $148 worth of stone over the same period.

The first calcium chloride purchased was war surplus in 30-gal. drums. For ease of handling and speed of application the drums were emptied into a dump truck with a borrowed stone chip spreader gate and this was used to spread the calcium chloride. This was applied to all unpaved streets in one day at the rate of approximately 1 lb. psy. The first application was made in May and an additional spread of approximately ½ lb. psy, made in late July, lasted the rest of the season. This proved successful enough to get the approval of the governing body to use calcium chloride the following year.

The next year we purchased a roller, distributor, spreader and other equipment to do our own paving. We prepared 8,000 sq. yds. of soil and sand blended base for paving and used the distributor with an auxiliary pump and spray bar for watering as we set up the base. Calcium chloride was applied at the rate of one-half lb. psy to the com-

● **CALCIUM chloride is applied to a street to eliminate dust, improve wearing qualities and reduce base material loss.**

● **APPLICATION with high test flake calcium chloride is made immediately after a wetting of the surface. This brings calcium chloride into solution in a few minutes.**

● **SAND-CLAY surfaces have been found better than crusher run stone with calcium chloride treatment. A V-crown with 1½-inch to the foot slope has proven to be best.**

● **GETTING ready to start a job: Water tank is ready to go while workmen charge spreader. Several passes at high speeds may improve distribution of the chemical.**

pacted base with a lime spreader to retain the surface material and keep the surface from "frog-eyeing" when asphalt for the base course surface treatment is applied.

Regular flake calcium chloride was used in 1957 but the next year extra-strength high test flake calcium chloride was used because of a considerable saving in freight which is a big portion of the cost.

Cost of Calcium Chloride

In 1958 the total cost for calcium chloride application was less than $900. There were 100 bags left over due to a wet summer and some has been used during the winter to melt ice and snow on bridges, at dangerous intersections, shaded areas and on steep hills. Further use has been made to stabilize crusher run patches for utility cuts and pavement repairs until paving can be done.

Better results have been achieved with high test flake calcium chloride. Application is made immediately following a wetting of the surface which brings the calcium into solution within 15 or 20 minutes instead of several hours required on a dry surface. Several passes at higher speeds are made in applying the calcium with the lime spreader to get better distribution of the calcium chloride flakes.

In preparing a new street for use, but not for paving, it was found that sand-clay surfaces are more easily maintained and hold moisture better than those of crusher-run stone.

With calcium chloride there is no problem with pot holes except when prolonged summer rains are experienced and then the streets are bladed with a motor grader to make them smooth again without losing the calcium chloride dust laying application. One blading has been found to be sufficient in the summer months.

When it rains, the calcium chloride works its way deeper and deeper into the road. As the sun dries out the surface the calcium chloride comes to the surface again to maintain the needed moisture content.

Experience has proved that an inverted "V" crown with at least 1½-in. to the ft. slope was best for calcium chloride treated streets. The city budget now carries calcium chloride each year as an important part of operating plans for the future and its use is heartily recommended to anyone who needs to stabilize a base for new paving or to kill the dust.

SAFETY TRAINING for STREET MAINTENANCE PERSONNEL

W. C. WICHMAN,
Director of Public Works
City of Cincinnati, Ohio

THE FAVORABLE injury experience of the City of Cincinnati has earned it a Workmen's Compensation rate reduction for 1959. The new rate is $0.48 per hundred dollars of payroll, a $0.13 decrease from last year, and is lower than any other city in the state. At this rate the city will pay approximately $160,000 in Workmen's Compensation Insurance in 1959. Payment at the basic rate of $1.76 for all Ohio cities would cost Cincinnati approximately $590,000.

To me, as the Director of Public Works, this is an important saving when city administrators are faced with the responsibility of rendering more services for the tax dollar.

Cincinnati's Highway Maintenance Division has developed what appears to be the most effective approach toward reducing accidental trauma. During the last five years it has reduced its injury frequency rate by 80 percent, from 38 disabling injuries per million man-hours in 1954 to 8 in 1958.

Its solution to the accident problem is a combination of many factors, but the most important of these is effective communication. This includes weekly five-minute discussions, monthly reports to the safety committee, monthly staff safety meetings, monthly employee safety meetings, periodic supervisory safety conferences, and publication of the monthly safety meeting minutes and quarterly progress reports.

Once each week, all division workmen are assembled on the job site to participate in the five-minute tool box safety discussions. These discussion periods are employee centered; participation consists of workmen expressing their ideas of specific safety problems with the foreman playing the role of advisor. Through these discussion periods, workmen are acquainted with the fact that accidents just don't happen but are caused and can be prevented.

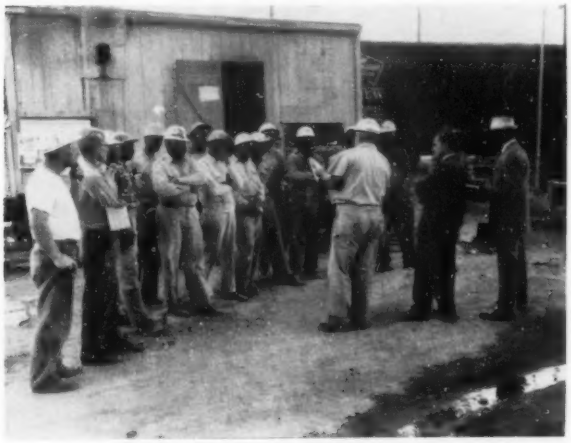
To impress workmen with the idea that safety is everyone's job, workmen from each of the 91 operating crews elect a crew safety representative. These men submit monthly Safety Recommendation Reports which are reviewed by both the Employee Safety Committee and the Supervisor's Safety Meetings.

Films and other visual aids are used at both the Employee Safety Committee meetings and at the Supervisor's Safety Conferences. Since the majority of these films are produced for the manufacturing industry and illustrate devices and methods of that industry, it is necessary to supplement them with charts and blackboard. We hope that the Public Employee Section of the National Safety Council will produce films for Public Works Departments in the near future.

New employees are indoctrinated into the safety program during their probation period by their immediate Supervisor who is responsible for administering on-the-job-training. Their safety attitudes are reinforced through attending the weekly five-minute safety discussion periods. An additional motivating factor is the revolving membership of the Employee's Safety Committee, whereby every employee is eligible to belong.

Field supervisory safety conferences are conducted during the winter months. Here new ideas in personnel relations, accident prevention and work area protection are discussed. These conferences have enabled management to understand more clearly the problems encountered by foremen and have paved the way to improved methods.

As for the many safety devices adopted, the most outstanding is the conspicuous red and white striped



● **BRIDGE maintenance crew participates in a weekly five-minute safety discussion with state personnel in attendance.**

● **SAFETY vests, which are red and white striped, are worn by line painters to make them more visible to all car drivers.**

vests which are worn by street cleaning and line painting crews. These vests are manufactured at the City Workhouse.

Bridge workers are required to use the rope grab, a device that attaches the worker to his life line. Prior to this device, workers on scaffolds depended on their ability to grasp a free swinging life line. Today, with the rope grab, this worker has the assurance that if he should slip, his fall will be stopped within a few feet.

Street maintenance workers are furnished with and required to wear the various protective devices such as hard hats, eye shields, respirators and other devices when necessary.

Each of the seven work sections of the Highway Maintenance Division compete for the Annual Safety Award, based upon the injury frequency rate of these sections. In addition, foremen who lead their crews through a year or more without a disabling injury receive a letter of commendation from the Director of Public Works.

● ROPE grabs are kept handy on high structures. They have been effective in preventing accidents in such places.

The Highway Maintenance Division is responsible for maintaining 840 miles of paved streets, 1200 miles of sewers, 114 bridges and viaducts and 388 walkways.

Accident costs are important to the overall picture of safety, and, while the improved morale of our workmen cannot be measured in monetary terms, it is reflected in increased production at lower costs. Credit for the remarkable safety progress is attributed to the splendid cooperation of all members of the Division.

Comparison of DIGGING RATES Justifies BACKHOE PURCHASE

HOWARD KAUFMAN,
Administrative Assistant, Utilities Department, San Diego, California

WHEN a lady begins to show her age, she loses no time in finding and using up-to-date "maintenance" methods. When a city's sewer system begins aging, modern means of repairing and renewing mains also must be used.

San Diego's 1,072 mile system dates back to 1889. It is necessary to renew several thousand feet of older 6 and 8-inch mains annually. This creates a sizeable digging workload. In addition, considerable excavation is required each year to install about 1,300 new street and alley house laterals.

The time-consuming part of a main repair or lateral job is the digging. About two years ago, the City's Sewerage Division decided to find out how much faster machine excavation is compared to manual digging. Favorable findings, the Division felt, could be used to justify the purchase of a backhoe which would be attached to a Hough loader then used for backfilling. With a full-time loader-backhoe available, job scheduling could be improved by eliminating time lags often met when equipment is shared or rented. As a result, an Ottawa heavy duty backhoe was leased for six weeks from a local contractor. Two division operators were trained to run the machine. Over the six-week period, they were assigned to excavate both sewer main ditches and lateral trenches from property line to main. They kept an accurate

Table 1—Machine vs. Manual Digging and Workload Computation

	Hours of Digging Time	*Cubic Yards Dug*	*Cubic Yards Dug Per Manhour*
Machine	133	425	3.195
Manual	167.17	177.5	1.061

Estimated Annual Excavation Workload

Type of Job	*Number of Job Units*	*Soil Per Job Unit*	*Total Soil To Be Dug*
Street laterals	800	12.67 cu. yds.	10,136 cu. yds.
Alley laterals	565	6 " " (est.)	3,390 " "
Main Repairs	5,200 lin. ft.	0.778 " "	4,044 " "
			17,570 cu. yds.

Time Required by Workload

		Hrs. Required For Workload	*Equivalent in Man-years*
Machine	$\frac{17{,}570 \text{ cu. yds.}}{3.195 \text{ cu. yds./hr.}}$	5,499	$\frac{5{,}499}{1{,}866} = 2.9$
Manual	$\frac{17{,}570 \text{ cu. yds.}}{1.061 \text{ cu. yds./hr.}}$	16,559	$\frac{16{,}559}{1{,}866} = 8.9$

account of the volume of dirt dug and the time needed to do the work.

In the meantime, lateral installation crews recorded the manpower and time required in the manual excavation of 15 typical lateral ditches. They also listed the dimensions of the lateral ditches and shafts so that amounts dug could be computed. Time spent in breaking pavement was not included. Results are shown in Table 1.

The findings indicated that a savings of six man-years (positions) could be made if a full time backhoe were able to do all of the Division's digging. However, the geographic spread of sewer jobs would render this impossible. It was estimated, then, that a mobile backhoe would dig fast enough to do two-thirds of all required digging. Thus there is a net saving of four man-years.

With these figures in hand, a budgetary request for a backhoe was made. The replacement of four laboring positions would mean an annual savings of about $15,000 after the first year of backhoe operation. Further savings would also be made from reduced compressor usage as the backhoe breaks as well as digs many hard soils. The purchase was approved and a Wain-Roy backhoe bought. The four laborers' positions were not filled.

Upon acquisition, it was decided to concentrate machine digging at first on sewer main repair and renewal in order to get the machine on a production basis and to gain experience in its use. It is too soon to make a final evaluation, but tentative findings reveal that main renewal, using the backhoe, is being done at the rate of 3.51 manhours per lineal foot. In the three-year period prior to getting the backhoe, the unit time per foot was 4.34, 3.68, and 4.15 manhours per lineal foot.

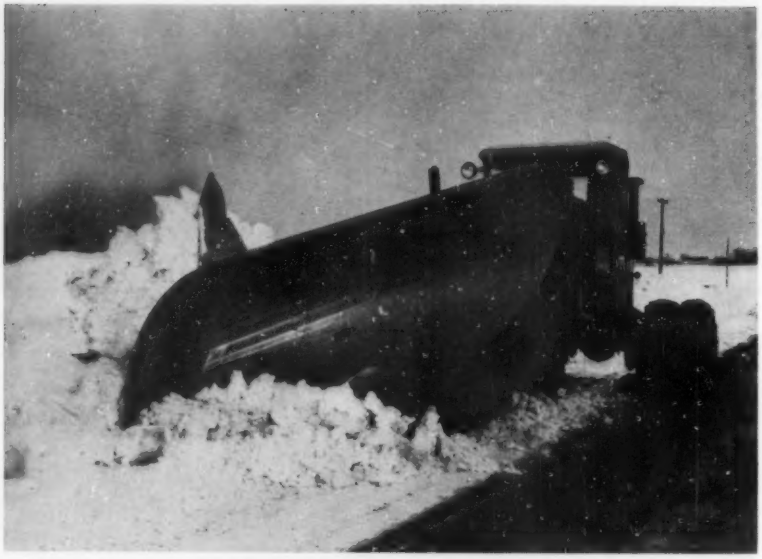
This time reduction is expected to boost our annual production to more than 6,000 feet a year. We are beginning to make inroads into our maintenance backlog, and the prospect is that many older lines will be renewed in time to avoid emergency breakdowns and give additional years of service.

Besides reducing compressor use, we have found two other advantages to using the loader-backhoe: Temporary construction roads can be made in rough terrain and canyons to get at hard-to-reach mains; and smoother trench walls can be made to facilitate shoring.

● **ABOUT 1,300 new street and alley house laterals must be dug annually in San Diego. Records on 15 jobs indicated a substantial saving by using a tool like this.**

● **DIGGING rate study resulted in purchase of much-needed equipment. Table on facing page compares machine vs hand work.**

WINTER OR SUMMER



● V-PLOW on Austin-Western grader cuts a 9-ft. swath through heavy snow bank.

....There's Road Work for Graders

LAVERNE SERNE,
City Engineer,
Holland, Mich.

NOW, AT the tag end of summer, the time is already very short for a city's management to check up on its snow-fighting ability. Specialized snow-fighting equipment is too costly for many municipalities; in such cases dual purpose equipment should be purchased.

Holland, Mich., is a small but growing municipality of some 16,000 people. In spite of being located in the heart of the nation's snow belt, Holland's citizens are used to bare pavements throughout the winter.

Until last year, Holland covered an area of little more than three square miles. But, in 1958, annexation of surrounding communities more than tripled the size of the town, bringing its area to 10 square miles. The 90 miles of streets and highways added considerably to the snow-removal task the citizens have come to expect the city's management to take in stride.

During the 1958-59 winter, 127 in. of snow fell. There were times when the snow drifted to depths of more than eight ft. and drifts of three to four ft. were a common problem in some sections of the city.

Over the years, we had built up a fleet of six trucks, each equipped with an under-body snow-plow blade. These had been adequate when we were smaller. Now, to these we added two new International R-192 trucks, also equipped with under-body blades. At the same time, we ordered an Austin-Western Super-88 power grader with an Austin-Western V-plow attachment.

The trucks do the bulk of the city's normal snow removal work; but there are times when the going is too tough for the trucks and then the Austin-Western grader-plow is called in. In addition, the grader is assigned a regular snow-removal route of its own, primarily on country roads; but if a truck cannot clear a certain location due to drifts or other reasons, someone is sent to find the grader and it is used.

Six-wheel drive and all-wheel steering give the grader several advantages. Power on front wheels as well as on rear wheels prevents the grader/plow from being deflected to one side by the force of the snow against the plow. All-wheel steering gives the operator complete control over the direction of the plow and permits him to put the snow exactly where he wants it.

The shape and construction of the blade gives it a nice roll. As snow climbs the blade, it rolls up smoothly and dumps clean as it leaves the blade. Attaching the blade to the grader takes less than five minutes. And, while it is an attachment, the plow is very rigid, operating as an integral part of the machine.

Total weight of the grader/plow combination, with scarifier installed, is 25,000 lbs. The blade cuts a 9-ft., 2-in. swath through the snow, is 7 ft., 2 in. high at the wing and 4 ft., 2 in. high at the nose.

An additional use for the grader/plow in snow and ice control is the removal of ice from the streets. The ice builds up on the pavement and then, on a warm day a film of water forms between the ice and the pavement but the water can't run off because gutters and drains are clogged with ice. With the grader the ice can be snapped loose easily with the toe of the moldboard blade.

During our first season with the Austin-Western snow-plow, we had no maintenance other than normal lubrication. Service from R. G. Moeller, from whom the machine was purchased, has been excellent. From time to time, we've had questions about how to operate the machine for best results and Mr Moeller has provided a qualified service man. The grader is powered by a 106-hp GM diesel, and the engine manufacturer's service man also has stopped by on two or three regular inspection calls to check on the engine performance.

Other Uses of Grader

The grader is used on other jobs besides snow removal. During the last spring, we had to open a frozen culvert that was diverting water across a highway and flooding it. When we tried to drive a pipe through the culvert, it got stuck. The Austin-Western was working

at a nearby job, so we moved it alongside the ditch and used the hydraulically operated side shift moldboard to pull out the pipe. Then we used the grader blade to excavate the frozen pipe that was causing the trouble.

This summer, we've opened several new roads and we've used the grader to remove top soil, rough-grade the sub-base and fine-grade the gravel. Also, we do a good deal of edging work with it, maintaining our roads after harsh winter weather and damaging spring rains.

We have one experienced operator and we are training several others, a relatively simple task because of the machine's hydraulic controls, maneuverability and all-wheel traction.

Holland uses both salt and calcium chloride for ice control. Salt is applied to the inner sections of main streets, run-off being relied upon to carry the salt to the curbs. The rate of application varies widely according to conditions of temperature and snow fall, but average conditions call for the application of about one ton per mile on 30 to 32-ft. wide streets. Calcium chloride is used on less traveled streets and is applied in conjunction with sand. Average ice conditions in Holland require a mixture of about three 100-pound bags of calcium chloride per ton of sharp sand. To apply these ice-control compounds to the streets, Holland has one truck equipped with a hydraulic tail gate spreader and two trailer spreaders that can be hooked to other trucks for emergency work that might be necessary after an unusually bad ice storm.

Drivers have assigned routes. If a particular piece of equipment is needed elsewhere, the street superintendent generally knows where the operator is working and can send a car or truck out to notify him of the emergency.

Public Relations

Holland's winter public relations program consists of two phases: Informing the public and handling complaints.

Informing the public: This consists of reporting on snow conditions and snow removal operations; and suggesting to motorists what they can do to make their driving safer and more convenient. One suggestion: When motorists spot a difficult or dangerous situation caused by ice or snow, they are asked to call the City's department of streets and report the condition and its location. This leads to prompt handling of the matter by the City and makes the streets safer and easier to use. The information is passed on to the public through reports given to Holland's daily newspaper, the *Holland Evening Sentinel*, and to local Radio Station WHTC. Last year, the author appeared on two 15-minute radio interviews to explain the City's snow removal operations and make suggestions to motorists. During the winter, the *Sentinel* regularly sends a reporter to get information on snow conditions and the City's efforts to remove it.

Both the newspaper and the radio are most helpful in warning the public of sudden storms which often develop without much advance notice. Storms blow up on Lake Michigan (about four miles from the heart of town) practically without warning and frequently these storms are very localized, causing a big snow or ice removal problem in Holland without giving trouble elsewhere. For example, against Holland's last year official snow fall of 127 inches, the city of Grand Rapids, just 30 miles to the East, had only 100 inches. The additional 30 percent of snow that fell on Holland without reaching other communities nearby was caused by these localized, sudden storms.

In addition to notice from the public and the street maintenance department's own inspection, Holland's police department also reports unsafe conditions to the Street Supervisor.

This second phase of Holland's public relations program involves prompt checks on the conditions reported and emergency action when necessary. When a complaint is received it is immediately investigated. If equipment is scheduled to be at the trouble spot soon, no further action is usually needed. If the equipment has recently passed the location, suitable equipment is dispatched to take care of the difficulty. Difficulties generally develop because of drifts, fresh snow fall, ice or flooding caused by ice-clogged drains. If an unusual complaint is made—an emergency trip to a hospital, for example, that must be made over a street that is temporarily impassable—the person making the complaint is called back and told what action is being taken. Normally, such call-backs aren't necessary, because people can see what is being done.

The direct snow removal costs for the 1958-59 season were about $750 per inch of snow. However, the City of Holland has no separate budget for snow removal, preferring instead to consider snow removal as part of the cost of overall street maintenance and providing for snow removal under a single street maintenance budget. This overcomes the problem of how much to allocate for snow removal, a ticklish problem at best because of the difficulty of predicting winter weather in advance. If Holland has a heavy winter, with high snow removal costs, then the rest of the city's street maintenance work will necessarily be curtailed. On the other hand, during a winter of light snowfall, snow removal costs will be proportionately lower and more funds will be available for street repair and improvements. Last year Holland budgeted $120,000 for street maintenance, of which about $97,000 was used for snow removal.

● **SUMMER use of the machine is illustrated by this ditch and shoulder grading operation. This and other maintenance and construction jobs keep the grader busy.**

REORGANIZING

● FAST CURB pickups are made with large trailers in Port Arthur, Texas.

REFUSE COLLECTION

M. C. CRESWELL
Superintendent of Public Works, Port Arthur, Texas

PRIOR TO 1955 the refuse division, a part of the Public Works Department, of Port Arthur, Tex., was handled separately and apart from other activities of the department.

It was apparent at that time that this division was not providing satisfactory service. Numerous complaints were being received daily. I was asked by the City Manager to find ways and means to improve the service rendered. It was found that the division was in need of reorganization. The routes had been added to or changed in an effort to meet the demands that had arisen over the years, until systematic order had been lost. For example, trucks were working part of a day in the east end of the City and the remainder of the day in the west end, some five miles away. Equipment was inadequate and in a poor state of repair, mainly because no stand-by equipment was available. Every piece of equipment was being used full time in an effort to maintain schedules. This made proper repairs and maintenance of the equipment impossible. Incomplete coverage of the routes was a regular occurrence. Although the fees paid by all entitled them to garbage service twice a week, some sections received only one service a week. Also, there was no system to the collection of dry refuse or trash. This was being handled when and if men and equipment were available.

A complete report of my findings was made to Charles Brazil, the City Manager, and in April, 1955, I was directed to assume the administration of the refuse division and to give it my personal supervision in an effort to provide adequate service for the entire City.

As a first step, two men were transferred to this division as supervisors to assist me, and we immediately made a thorough survey of the situation. This included the following major items:

Existing routes were mapped and checked to establish volume figures, hauling distances, time, special services, etc. Personnel was checked as to age, ability, experience, etc. An inventory was made of all equipment belonging to the division showing type, capacity, age and condition of each unit.

When the survey was completed and accumulated data reviewed, the following facts were established:

The refuse division personnel consisted of 56 persons; some good, some fair, some poor.

The division owned 18 collection units, 1 supervisor's car, 1 bulldozer, and 1 pickup truck. The latter two units worked at the disposal site. Of the 18 units, seven were in poor condition, nine in fair condition and two in good condition.

Equipment was not being inspected regularly for maintenance or repair.

Equipment was being washed, when and if time was available, and serviced by the operating crew.

The collection routes had been changed, added to here, reduced there, until no systematic method of operation remained.

No complete record of special services was being kept.

The disposal site was in a poor condition, having been used primarily as a dumping site with little attention being given to disposal of refuse or maintenance of the area.

The work was being assigned on a task basis which tended to cause the men to slight their work, and abuse the equipment in order to

complete their assigned task in less than the 8 hours time they were being paid for.

The division was being operated on a 5-day per week basis. This made scheduling of service with equal time between pickups impossible.

The volume of refuse to be collected exceeded the capacity of our collection vehicles.

A number of ordinances governing the activities of this division had been approved over a period of 20 years or more. These ordinances had been amended from time to time during the years. As a result, many of these ordinances and amendments were conflicting.

Long Range Plan

A plan was designed to produce the service we felt the citizens were entitled to expect from the Refuse Division. We estimated that a period of five years would be required to effect a complete implementation of the plan. Upon the approval of this plan by the City Manager, the following steps were taken to place the plan into operation:

A program to upgrade the personnel of the division was put into effect by strengthening the supervision, making changes to fit personnel to job assignment as nearly as possible and utilize the ability of each employee to the fullest extent. We were able, in most cases, to find a suitable spot for each employee and thereby increase the efficiency of our operation.

With the cooperation of Martin Verboon, the Garage Superintendent, and his staff, we were able to set up a program to improve the condition of the equipment, unit by unit, until all equipment was in as good operating condition as possible. We then were able to establish a maintenance program which to date has proven very satisfactory.

In an effort to reduce maintenance and repair costs and prevent equipment down time, the supervisors were requested personally to inspect equipment under their supervision daily. They were also requested to have the operators of the equipment check their equipment daily and report immediately anything that needed attention. This has prevented many major repair jobs.

In order to keep the equipment as clean as possible and properly serviced, one man was assigned as serviceman to wash, spray, and service each truck after the completion of each day's operation. This has kept our equipment clean and free of flies and has eliminated the loss of time incurred when equipment was serviced by the operating crew.

It was necessary to redesign all collection routes completely in order to establish an efficient system of collecting refuse, one that would provide every part of the City with equal service. The routes were designed to provide two pickups per week, each route to be serviced by two units. The routes were developed, one at a time under close supervision, in the following manner: Using the information developed in the volume survey, we would estimate the area two units could cover twice in a week, then a supervisor would take these two units and the operating crews and work with them in the area for several weeks decreasing or increasing the size of the area. In this manner, we developed a route in the area for Monday, Tuesday and Wednesday which would be covered the second time on Thursday, Friday and Saturday. By this method, we were fairly certain that each route each day represented a fair day's work for the crew assigned to it, knowing that all factors had been considered during the period the routes in the area were being developed.

When the routes in an area were fixed, the process was repeated in the adjoining area. Service was maintained in the portion of the City not included in the above by myself and the other supervisor. We also took care of the supervision of the areas in which the routes had been fixed. This left the supervisor developing the routes free to devote all of this time to designing the new routes.

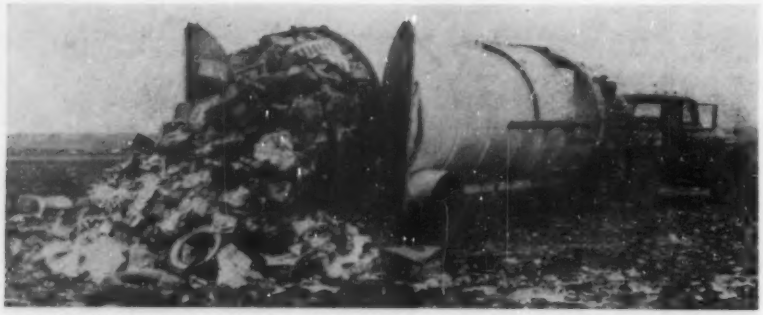
We continued in this manner until all of the routes necessary to serve the entire City had been fixed and we were satisfied that all residential and small business establishments in the City were receiving satisfactory service twice each week. We then turned our attention to the larger business establishments which, by the nature of their business or by the volume of refuse, required additional service. Our survey indicated that the downtown business area would require service six days per week. A route was developed by the method described above, using two scow body units with a crew of three men to each unit. This route was eventually fixed to serve the downtown business area and a few large business establishments in other parts of the City which also required service six days per week.

There remained a number of business establishments throughout the City which our survey indicated would require service three days each week. A route was developed to provide this service using one unit, and a crew of three men. This crew and unit also handles the special carry-out service.

Six-Day Operation

The development and implementation of the new scheduling made it necessary that we use a six-day per week operation instead of the five-day per week plan formerly in effect. This was accomplished by scheduling a portion of the personnel to work Monday through Friday, and the remainder Tuesday through Saturday. This made a six-day operation possible with a 40-hour week as required by the City's Personnel Policy. We also eliminated the task work plan and require a full day's work on the part

● **DESPITE its seemingly great size, this highly maneuverable trailer can provide alley pickups in downtown areas. Unit was developed as part of long range program.**



● THIS IS the "Lo Boye" unit unloading at the dump. The man shown at the right is operating push-button controls. Large capacity reduces hauling costs and problems.

● TRAILERS receive wash-down after each day's operation at Port Arthur, Tex.

of each employee every day of the week.

A special or carry-out service is provided to accommodate people who prefer to pay an extra fee rather than place their container on the curb for collection. This had been handled by verbal request; but in many cases the collection crews who received the request would start the service but fail to report the matter and the charge for the service would not be made. To control this special service, all persons desiring this special service were requested to fill out a special form. A special service crew is assigned to this work on Tuesdays and Fridays of each week.

Previously, there was no system to maintain proper charges for handling excess volume. The following policy was adopted to provide a fair charge for excess volume: The supervisors check the volume being handled over a period of time, as much as a month if necessary, to develop an average figure. The charge per month is then calculated and the customer is notified of the amount being charged. He also receives a copy of the volume check figures and method of calculating his charge. The supervisors and the collection men then are required to watch the volume being handled and to recheck if there is any noticeable change. The customer is also informed of the fact that he may request a volume check if he has reason to think his charge is incorrect. We have found this method very satisfactory, although we have not as yet been able to apply it throughout the City.

A plan to improve conditions at the disposal site was started. When we had the area in the desired condition, a systematic method of operation was placed in effect.

The problem of providing adequate collection and hauling capacity to take care of the volume our survey had indicated we would be required to handle presented an almost unsurmountable obstacle to our efforts to develop a satisfactory efficient refuse handling operation.

Necessity had forced us to devote most of our efforts to the handling of putrescible refuse (garbage) and we were able to improve this situation to some extent fairly early, but we were able to do very little to improve conditions insofar as the dry refuse or trash was concerned. We did not have the equipment with capacity to handle this large volume of refuse. We had to find a way to double our collection and hauling capacity. Funds were not available, and wouldn't be, to increase our personnel and equipment to the extent necessary to cope with the situation.

A study of our survey data as to hauling distances and time, taking into consideration that all units must cross the ship channel over a drawbridge, showed that our vehicles had to make four to six trips per day to the disposal site, each trip taking an average of 40 minutes except when they were delayed by the bridge, which was quite often. Therefore, additional vehicles of the type we had did not seem to be the answer to our problem.

When all factors were considered, there seemed to be only one answer to this problem and that was collection units with a much greater hauling capacity. We checked the equipment on the market at that time, 1955, but found nothing being offered that seemed to meet our requirements.

Designed Own Equipment

We then decided we would be forced to have the equipment constructed to meet our needs. I developed a design and specifications for a light weight semi-trailer unit with a capacity of 40 cubic yards which could be towed by a two-ton tractor. I estimated that these tractor-trailer units would cost less than five thousand dollars. Upon the recommendation of the City Manager and with the approval of the City Commission, we were able to procure two of these units which were placed in service handling dry refuse and proved very satisfactory. We found that these units could be adapted to the handling of putrescible refuse and soon purchased five more. They replaced five old bodies which were junked and the carrier trucks were converted into tractors to tow the five trailers.

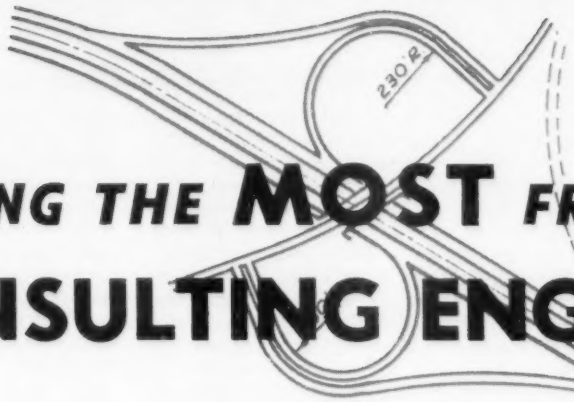
This relieved our capacity problem even though hauling garbage in open trailers was not desirable. The trailer units did provide an economical way to get the job done and made possible the maintenance of schedules for putrescible refuse and collection of dry refuse throughout the City every two weeks.

The very satisfactory results we had experienced from the use of the open type trailer units caused us to be very much interested when The Pak-Mor Manufacturing Company announced their Lo-Boye unit. We immediately requested a demonstration and purchased our first two Lo-Boye units in March, 1958, complete with tractors ready for operation. These units proved so satisfactory that we purchased one more of these units last fall. We have used them and find them to be practical.

The division now has 19 units of collection equipment. We normally have two units on stand-by.

It was determined that the various ordinances in effect in 1955 were unsatisfactory and in some cases unenforceable. With the cooperation of the Legal Department, a Refuse Code for the City was developed.

Our efforts could not have enjoyed the success they have without the cooperation of Charles Brazil, City Manager, the City Commissioners and Martin Verboon, Garage Supt.



GETTING THE MOST FROM THE CONSULTING ENGINEER

JOHN R. SNELL,
Principal, Michigan Associates, Consulting Engineers, Lansing, Michigan

THE AVERAGE consulting engineer is being used in an ineffective and inefficient manner by many cities, villages and townships. Usually this is because the engineers have failed to educate the public officials about the services offered by a consultant. Early in 1958 an extensive national survey (1) indicated that the consulting engineer felt that his function is improperly understood by the general public. In this survey of consulting engineers, none felt that his function was understood "excellently" by the general public. Only 11 percent thought his function was understood "fairly well," while 62 percent thought the proper description was "poorly", and 23 percent said "not at all".

There is good reason for this lack of understanding. The consulting engineer has not told his story to the public properly. Even in the minds of many public officials who have frequent occasion to contact consulting engineers, there are many misunderstandings. In dealing with public officials questions which recur frequently involve: 1) How to take full advantage of the various types of service offered by consulting engineers; 2) why competitive bidding for professional engineering services or "free" engineering from contractors or manufacturers is bad for the public; 3) how to select a consulting engineer; and 4) how to help the consulting engineer best serve public officials.

● **THE AUTHOR consulting with a client in his office: A better understanding of the functions of the consultant will result in more efficient use of his services.**

Types of Services Offered

There are all types and sizes of consulting engineering firms. Even among those in municipal practice, there are consultants who cater to small cities in a rather limited geographical area. These are similar to the general practitioner. On the other hand, other consulting firms specialize in bridge, highway and street design work or in water supply and sewage disposal problems, or in refuse collection and disposal problems. Sometimes a firm specializes in one area and gives general services in all municipal areas. Although sometimes different engineering firms work together on problems, generally an engineering firm seeks work and plans to have employed on its own staff at least the majority of the technically qualified men needed. Since most municipal work requires the services of several specialists, it is best that engineers operate best as a team. In the design of a sewage treatment plant, for example, the combined efforts of sanitary, structural, mechanical and electrical engineers are required.

The types of service that are asked of a consulting engineer depend considerably on the size of the city and the number and competence of its full time technical staff. In most large cities, the routine types of jobs, such as, water and sewer extensions, and street improvements are accomplished by their own engineering or public works staff. The common use made of a consulting engineer in this case is for a specific job such as a study, preparation of plans and specifications, and supervision of construction of major facilities for water and sewage, bridges, streets, parking garages, incinerators or other large or special type of facilities. His services are generally re-employed when major extensions or enlargements are made.

Larger cities are finding, today, that consulting engineers have other valuable services to offer them. The problems associated with urban planning, redevelopment, and slum clearance projects are engineering.

Dr. Snell is Immediate Past President of the Consulting Engineers' Association of Michigan and Immediate Past Director of Consulting Engineers' Council. In this article, he has given the public official an inside picture of the ethics and practices of the consulting engineer, and shows specific steps you can take to get the most from the consulting engineer.

Where garbage and refuse have become a serious problem, consultants are being effectively used to arrive at the most satisfactory and economical solution.

Many cities adopted water and sewage rate schedules 20 or 30 years ago, and have not changed these. An objective study by a consulting engineer can put these utilities back on a realistic and paying basis. Studies and reports of qualified consulting engineers are accepted by citizens as non-partisan, and enable a municipality to accomplish things which otherwise may become bogged in politics.

Another service the consulting engineer has to offer the large city is his technical advice on operation and maintenance of the various municipal facilities, particularly in water and sewage, but care should be taken in the selection of the consultant in this case as not all are adequately experienced.

For moderate and smaller sized communities where their technical staff is either limited or non-existent, there is a very important way the consulting engineer should be used, but all too frequently is not being used. The advice and counsel of a competent consulting engineer should be sought before decisions are made involving engineering matters. Not only is the health, safety and welfare of the public involved, but the ever important question of true and long term economy. For this type of monthly advice and counsel, the engineer might be employed on either a retainer basis, or a cost plus basis. If the consulting engineer rendering this service has been thoroughly and carefully selected, it is probable that he can undertake the design and supervision of construction of major projects when they come due. He can also make and keep up to date the master plan of the municipality. When specialists are required, he is in the best position to recommend them for your consideration and employment. There are reasons why clients like the arrangement.

Valuable time, effort and money are saved in eliminating the investigation and selection and the negotiation with an engineering firm with each project anticipated.

1) On short notice, the engineers are available to meet with the client and to discuss problems and give advice. The engineer is always on a readiness-to-serve basis.

2) The client receives expert service with better and more economical designs in all of the varying fields of engineering, especially if the initial selection of the consulting engineering firm has been made so as to include engineers experienced in all of these fields.

3) The client pays for service only when it is rendered, thus avoids the overhead of a full time engineer.

4) The client finds that in addition to studies and new projects, his existing capital investments can best be protected through the advice of specialists familiar with these facilities.

5) The consulting engineer gives the municipality an objective budgeting of their capital improvement dollar, as well as the efficient advice on the use of their operation and maintenance dollar.

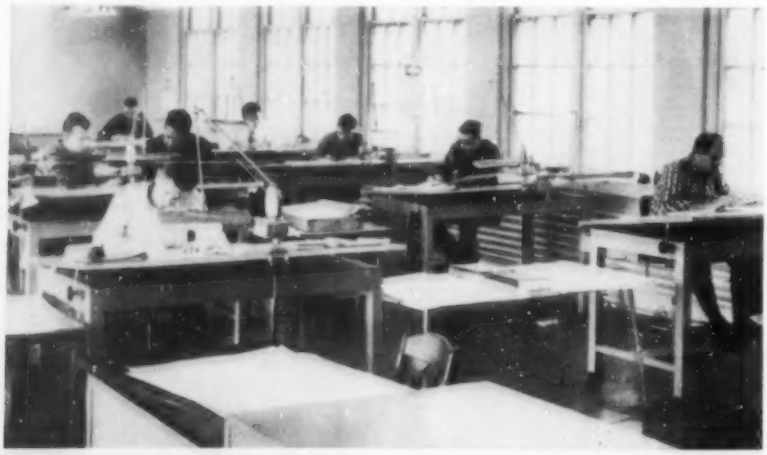
Bidding for Engineers

In our "free enterprise" system, competitive bidding for materials or equipment, which can be definitely specified in quantity and quality, is a well accepted practice and is generally acknowledged to be in the best interest of the public body employing such practice. Frequently, municipal charters or by-laws require competitive bidding for all equipment, materials and labor, over $500 to $1,000. Sometimes, such rules or by-laws are misinterpreted to include professional services; such as legal, architectural or engineering. Whenever such interpretations have been thoroughly analyzed by competent legal counsel or tested in the courts, they have been found to be erroneous. The reasons for this are sound and in the best interest of the municipality. The services rendered by a consulting engineer are professional in nature, and cannot be definitely specified in quality as can particular materials, equipment or labor. One would not think in terms of asking several doctors to bid on their services in the performance of a difficult operation. In the same way, a thousand dollars saved on engineering, either by competitive bidding or the selection of a poor engineer, could easily cost the public $100,000 through the less competent engineer designing a more expensive and less useful structure or facility. It is invariably true where more money is spent for engineering, a much greater sum can be saved for construction. The poorest place therefore, to economize, is in engineering.

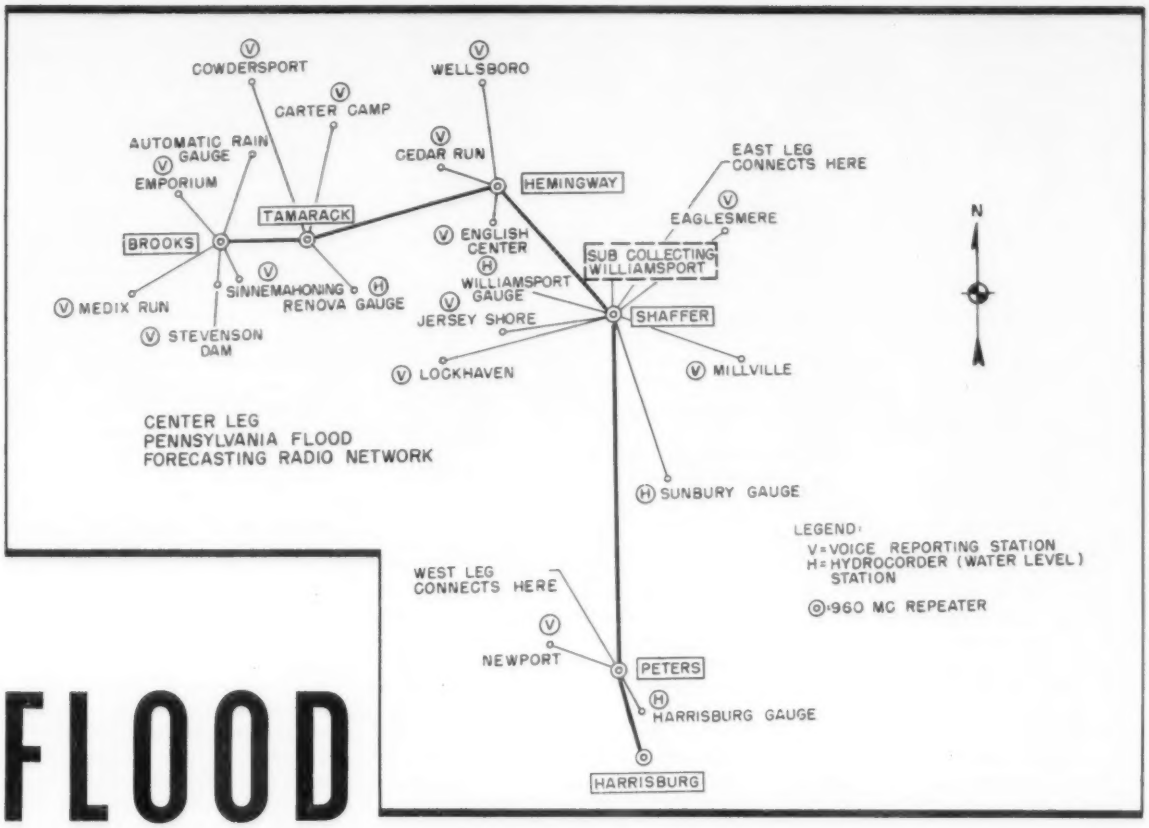
The problem then becomes one of how the fee for engineering should be determined, if not to be made on the basis of competitive bidding. Although there are a number of ethical ways in which an engineer and a client could arrive at a fair fee, the one most commonly employed is a sliding scale fee schedule based on a percent of the construction cost. The schedule commonly used by the municipal consulting engineer is that published by the oldest engineering society; namely, the American Society of Civil Engineers (2). Other published schedules very similar to these are used by other consultants. Any of these printed schedules may be obtained through your consultant, or through the state consulting engineers association.

The fee schedules mentioned above include all phases of the preliminary study, preparation of detailed plans and specifications, and general supervision of the work during construction. It is right and proper that each phase of the work should stand on its own feet, and a

(*Continued on page* 204)



● **MICHIGAN ASSOCIATES drafting room. Engineers and draftsmen alike work best under pleasant conditions furnished by well lighted and uncrowded surroundings.**



FLOOD FORECASTING

EACH SPRING heavy rains and melting snows pour down Central Pennsylvania mountain sides, turning normally placid feeder streams into raging rivers. These torrents draining into the Susquehanna river, can raise river levels to flood stages and bring tragedy to large, heavily populated areas. Several years ago, the Pennsylvania Department of Forests and Waters, in cooperation with the United States Geological Survey and the United States Weather Bureau, established a widespread radio network as an aid to flood forecasting. Last year, the first step of an extensive modernization program was completed, so that now the communications network incorporates some of the most modern techniques possible with present day electronics.

Installed by Motorola, the new system is known as the center leg of the complete network. It also connects to the older east and west legs, providing a system for funnelling vital forecasting information from the entire Susquehanna River basin to the Harrisburg Weather Bureau office.

Observers radio river and rainfall information to substations, which relay it to the central control console at Harrisburg. Similarly, readings of strategically located automatic radio river gages and a radio rain gage are telemetered to Harrisburg. With these data, Federal-State flood forecasters are able to predict flood conditions and warn the public in time to alleviate loss of life and damage to property. Federal weather forecasters also make use of some of the information.

Filling an important function are six radio repeaters at Harrisburg, Peters Mountain, Shaffer's Path, Hemmingway, Tammarack, and Brooks. They form the backbone of the communications network, which operates in the 960 megacycle frequency band and provides 4 up-leg channels from and 4 down-leg channels to Harrisburg. Feeding into the six repeater sites are separate radio circuits, operating in the 150 Mc. and 400 Mc. frequency bands, from a total of about 40 voice reporting stations and the 7 interrogated automatic river gages. Also connected to the center leg are circuits from three subcollecting stations and an automatic rain gage reporting station near the Brooks repeater.

The hub of the entire new system is the control console at Harrisburg. This console controls the backbone repeater system and provides a means for the operator to speak through the repeaters to any one of the voice stations or to interrogate any of the automatic gages. Included in the console are accessory pieces of equipment, such as a tape recorder for recording voice receptions and transmissions and the printer recorder used with the interrogation

of the automatic stations. A failure alarm control is also included at the console.

The effect of the system is that the operator at the master control console in Harrisburg can alert and speak to or listen to any voice reporting station in the entire system. The operator can also interrogate any of the automatic river gages and receive the report on a special tape recording machine.

To contact any one of the stations, the Harrisburg operator utilizes the selecting signaling portion of the equipment. This involves the transmission of a series of tones which unlock the receiver of the desired station. Each station has been designated its own tone code, which is transmitted by pressing the correct series of buttons on the master console in Harrisburg.

In operation, for example, if the Harrisburg operator wishes to query the reporting station in Lock Haven, he presses the buttons lettered J, N, L, P. on the Motorola "Quik Call" panel for the first code. This would be followed by a second code to be made by pressing the buttons lettered J, N, F, M. Upon receiving this second code, the Lock Haven radio speaker is activated enabling the Lock Haven observer to hear the incoming message.

If the Harrisburg operator wishes to check the Susquehanna river level at Sunbury, he would press out the Sunbury code. This signal is sent to the automatic radio river gage at Sunbury where it activates the electronic equipment which, in, turn, takes a reading of the water level and automatically reports it back to Harrisburg. The incoming reading is recorded at Harrisburg on a special tape printer.

Although the functions of the control console and the system are very complicated, its operation is quite simple. Through use of special charts, it can be operated by new personnel after only a few minutes of instruction.

Reports

When a report on river and rainfall conditions throughout the system is desired, the Harrisburg operator first interrogates each of the seven automatic river stations—four on the center leg, two on the east and one on the west leg. He then turns the operation over to three subcollecting centers. At "Subcollecting" time, as it is called, the Harrisburg operator disconnects the three individual legs, which allows the subcollecting operators to query individually each of the voice recording stations on their leg. Part of the equipment at Williamsport subcollecting center consists of selective signaling gear to facilitate the alerting of the center leg voice stations. The information gathered at subcollecting time is transmitted from Williamsport and the other two subcollecting centers to Harrisburg by teletypewriter. One of the four down leg channels of the main repeater system is used for radio teletypewriter circuits from Williamsport. When the east and west legs are replaced with new 960 Mc. backbone equipment, additional channels will be used for radio teletypewriter circuits from the State College and Binghamton. At the present time these legs use wire teletypewriter circuits.

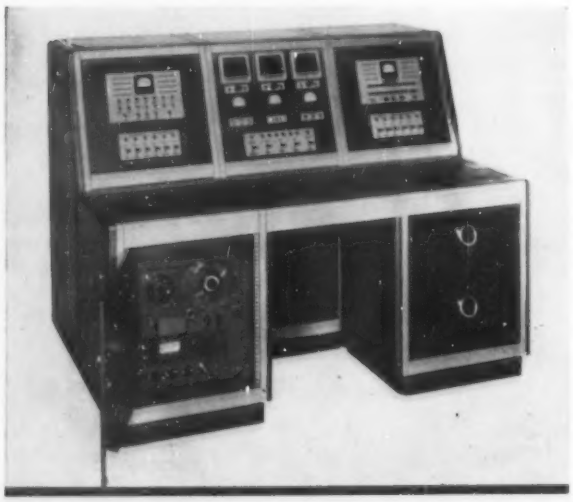
If for any reason, the subcollecting centers cannot collect the information from their voice reporting stations, the entire operation can be handled from Harrisburg. Harrisburg can also override the subcollecting stations.

As mentioned, one down leg channel is used for the down leg teletypewriter circuit to Harrisburg. The other three down leg channels are used as follows: Channel one for monitoring Williamsport and all voice reporting stations and automatic radio river gages assigned to the center leg; channel two for the same purpose on the east leg; and channel three on the west leg.

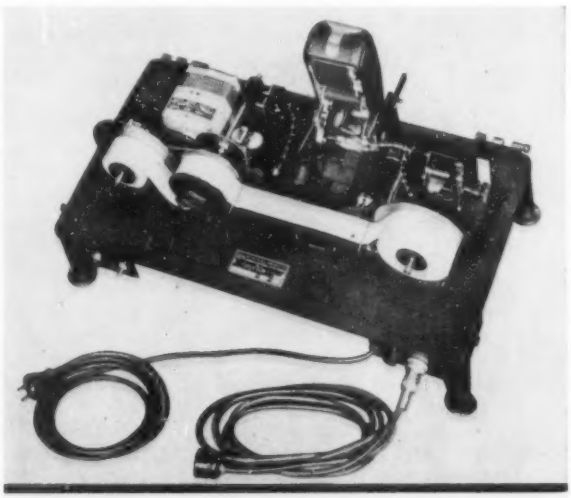
The four up leg channels from Harrisburg are assigned as follows: Channel one for voice communications to center leg stations; channel two for voice to the east leg; channel three for voice to the west leg and channel four for "Quik Call" signaling function and up leg teletypewriter.

A new feature of the forecasting system is the automatic rain gage reporting station near Brooks. This piece of equipment is fully automatic and reports precipitation twice a day.

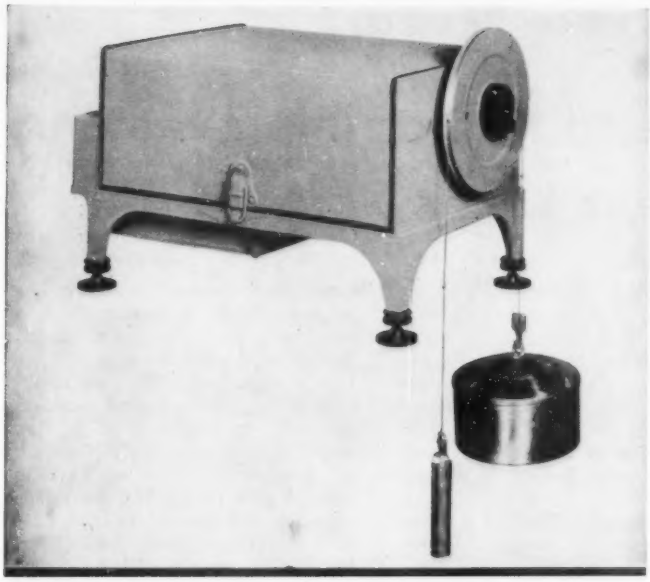
As a safety measure, the new system incorporates a failure alarm system, which will isolate any light failure or other equipment breakdown when interrogated from Harrisburg by tone signals. Key stations have been provided emergency power generating facilities and antennas are equipped with de-icers to insure system operation during



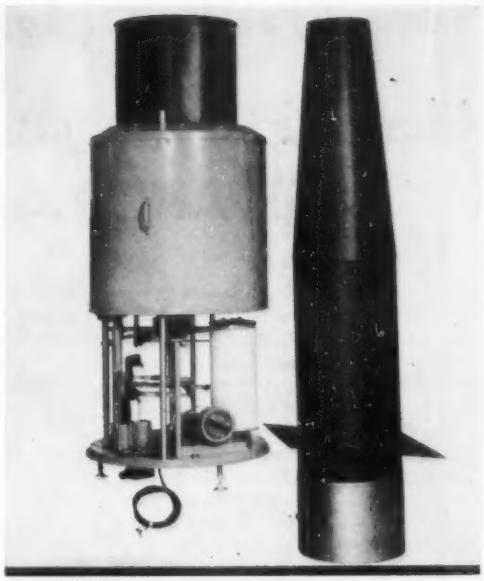
● **FROM this control console located at Harrisburg, Pa., the entire flood forecasting network (see p. 113) can be operated.**



● **SIGNALS received at headquarters are fed into this signal recorder which records the water level data on paper tape.**



● **WATER-level transmitting device. Float position operates electro-mechanical coding device, transmitting signals direct to headquarters.**



● **AUTOMATIC rain gauge measures rainfall and radios signals to headquarters by special equipment.**

adverse conditions. In addition all antenna towers in the system have aircraft warning signals.

The Commonwealth of Pennsylvania awarded the contract to Motorola for complete maintenance of the communications network. To handle the actual servicing in the area, which ranges 135 miles east and west and 110 miles north and south, Motorola assigned a certain segment to each of its six authorized service stations in the area. Factory service representatives work closely with these stations to insure proper equipment functioning.

With the aid of this effective communications system, the Federal-State forecasters in Harrisburg are better able to make rapid and accurate stream flow forecasts and so provide the necessary warning to the people of Pennsylvania in the event of floods.

Microstraining Installation to Treat 20 MGD

Lytle Creek is a major source of supply for the Fontana Division of the San Gabriel Valley Water Company. The creek flow comprises a base flow of water welling up from the canyon bed augmented by snow melt and storm surface run-off. The quantity used varies between 5 and 20 mgd depending on the condition of the stream; an alternative supply is available from wells.

Dual chlorination, the only treatment presently provided, has to date afforded an effective bacteriological safeguard, but some consumer complaints have arisen due to the presence of objectionable suspended matter, principally of organic origin, and of associated tastes and odors. Infestations of buffalo gnats in the stream have also given trouble on occasion.

Reliable and economic means of removal of the debris, etc., were sought in order to mitigate the complaints referred to and to ensure the continuing effectiveness of the measures of disinfection.

Consequently a pilot test on this water at Fontana of the Microstraining process using a standard 2½-ft. diameter unit with Mark O fabric was carried out by Engineering-Science, Inc., Consulting Engineers, Pasadena, California. The results reported from their field and laboratory investigation indicate that high proportions of the suspended organic matter and of the plankton (96 percent) were removed by the strainer with consequent reductions in turbidity to 2 mg/L.

The consultants were of opinion, therefore, that a safe and palatable supply could be maintained by a combination of Microstraining and breakpoint chlorination. During the few short periods when colloidal turbidity might prevail the auxiliary supply from wells could be called upon. They also stated that a Microstraining installation would have the added advantages of: 1) Low initial cost—about $15,000 per mgd; and 2) low operating costs—about $1.50 per mg treated.

If at sometime in the future it was decided to add rapid sand filtration, the Microstrainers could be valuable for primary treatment with resultant benefits in design and operation; the safeguard provided against fluctuating water conditions would also facilitate overloading of the filters whenever required.

From the reduction in turbidity shown in the laboratory report a high proportion of the suspended matter and plankton present is above the screen aperture size of 23 microns. In consequence, with supplies of this nature, Microstraining might serve as an economical substitute for coagulation and sedimentation in a complete treatment system particularly where, as in this case, floc formation is difficult and expensive.

As a result of this report, the Company has placed an order with Glenfield & Kennedy, Inc., for a 10-ft. dia. x 10-ft. wide unit, the first in an installation of three to deal with the total flow of 20 mgd.

Sequel to the St. Lawrence Seaway:

Channel Deepening and Harbor Improvements Will Affect Great Lakes Port Cities

THE GREAT LAKES, together with their deep-draft connecting channels, constitute the greatest inland waterway system in the world. Stretching 1,162 miles from the St. Lawrence River to Duluth, Minnesota, and 1,061 miles from the St. Lawrence to Chicago, the Great Lakes navigation system is one of the world's busiest waterways. This system carries about 25 percent of the waterborne commerce of the United States, the preponderance of which is bulk freight such as iron ore, grain, coal, stone and petroleum. The 117 billion ton-miles of Great Lakes freight traffic carried in recent years represents an increase of about 20 percent since the end of World War II. Total United States traffic on the Great Lakes including all imports and exports averages about 227,000,000 tons annually. The states bordering on the Great Lakes-St. Lawrence Seaway System have a population of 58 million—35 percent of the population of the U. S.

The Great Lakes can be described only by resorting to superlatives. Together with the St. Lawrence River they comprise a drainage area of 300,000 square miles. The water surface has an area of 95,000 square miles and the shoreline is 8,300 miles. They constitute the largest concentration of fresh water on earth. Transportation on the Great Lakes is unparalleled and unmatched. More than 30,000 ships pass through the Detroit River during the 8½ months of navigation season.

The present improvement program has two main parts—the St. Lawrence Seaway and Power Project and the deepening of the Great Lakes Connecting Channels. A third major project will be the development of the Great Lakes Ports which problem is now under study by the U. S. Army Corps of Engineers.

The Seaway Project

The Seaway and power project is a joint undertaking of the U. S. and Canada. For the United States, the Saint Lawrence Seaway Development Corp. is authorized and directed to "construct, maintain and operate in U. S. territory deep water navigation works with controlling depths of 27 feet in channels and canals, with locks at least 800 ft. long, 80 ft. wide and 30 ft. over the sills in coordination with the St. Lawrence Seaway Authority of Canada."

This combined navigation and hydroelectric power project consists primarily of two dams, a powerhouse and 7 navigation locks. These raise or lower the vessels a total of 226 feet in the 182-mile reach of the St. Lawrence River between Lake Ontario and Montreal. It represents a joint investment of about one billion dollars by the United States and Canada.

Power is to be developed in the International Rapids Section only (between Ogdensburg, New York and Cornwall, Ontario) by two agencies at State level, the Hydro-Electric Power Commission of Ontario and the Power Authority of the State of New York in a joint undertaking.

Thus there are four separate public agencies with specific objectives. Each agency has the right to borrow the moneys necessary to construct, maintain and operate their respective facilities and to pay back within 50 years the borrowings with interest and to pay the cost of maintenance and operations of the facilities—the power entities by the sale of electrical energy and the seaway entities by revenues from tolls on shipping.

From this it is evident that the Saint Lawrence Seaway Project is financed from "borrowed" instead of "appropriated" moneys and is to be self-liquidating and self-operating in all respects. To accomplish this the two Seaway agencies, through their especially appointed tolls committees, have adopted a schedule of tolls designed to accomplish the financial obligations in the period prescribed. The tolls, as recommended, are of the order of $1 per ton on general cargo and 50 cents per ton on bulk cargo per transit.

The former 14-foot canal system could accommodate vessels not exceeding 250 ft. in length, 44 ft. in beam and 14 ft. in draft, carrying 1500 tons of general cargo and 2500 tons of bulk cargo. The new seaway system will accommodate vessels up to 730 ft. in length, 75 ft. in beam and 25½ ft. draft, carrying 7500 tons of general cargo and up to 25,000 tons of bulk cargo. The increase in capacity will be in the ratio of 5 to 1 for general cargo and 10 to 1 for bulk cargo. It has been estimated that the capacity of the new Seaway will permit up to 80 percent of the world's cargo vessels to trade in the Great Lakes, making available to the interior of the country the inherent benefits of reduced transportation costs with direct access to world markets and sources of imports.

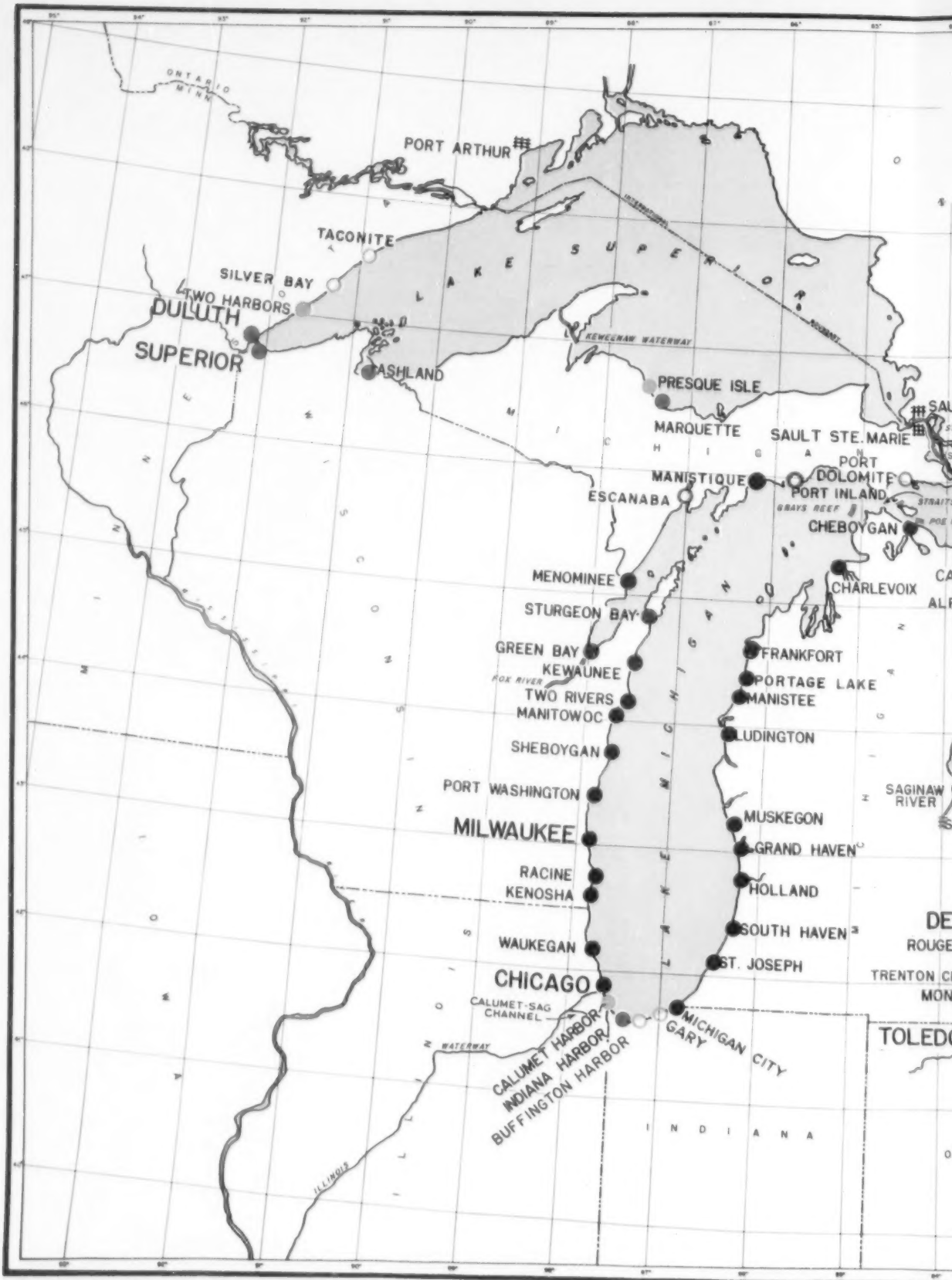
Briefly stated, the project has included the deepening to 27 feet of the Welland Canal and approaches thereto in Lakes Erie and Ontario; the removal of scattered rock shoals in the 68-mile Thousand Islands Section; the construction of two dams on the power phase in the 46-mile International Rapids Section; and the construction of 7 new, modern navigation locks and three lateral canals to replace the 22 outmoded locks and six lateral canals in the old 14-foot canal system in the 110 miles of river above Montreal.

The work involved in the Seaway project required construction equipment costing $75 million. Excavation, wet and dry, totaled about 210 million cu. yds.; more than 6 million cu. yds. of concrete were placed. Many new bridges were needed; 42 miles of highway and 35 miles of railroad tracks had to be relocated.

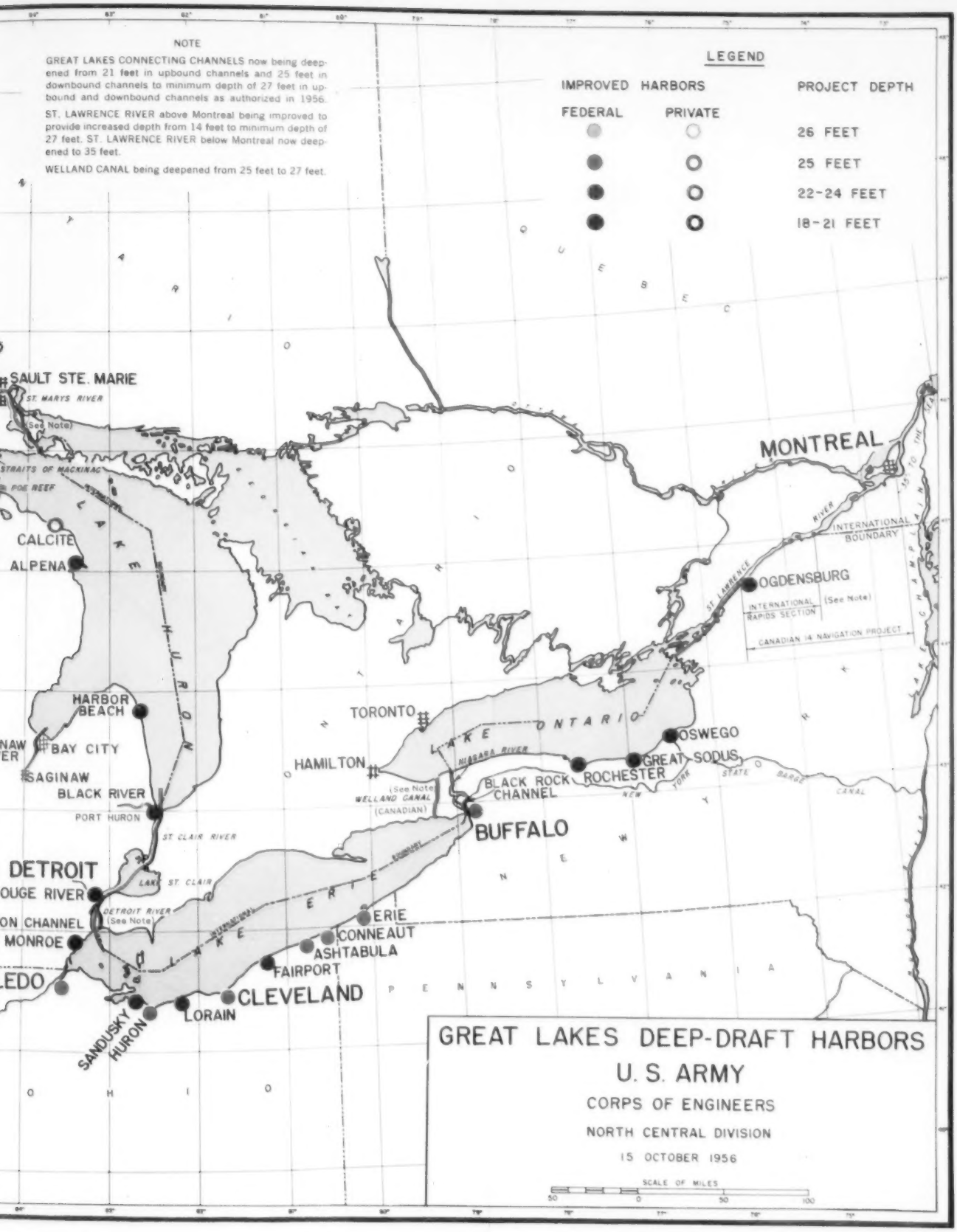
The Corps of Engineers served as design and construction agents for the Saint Lawrence Seaway Corporation.

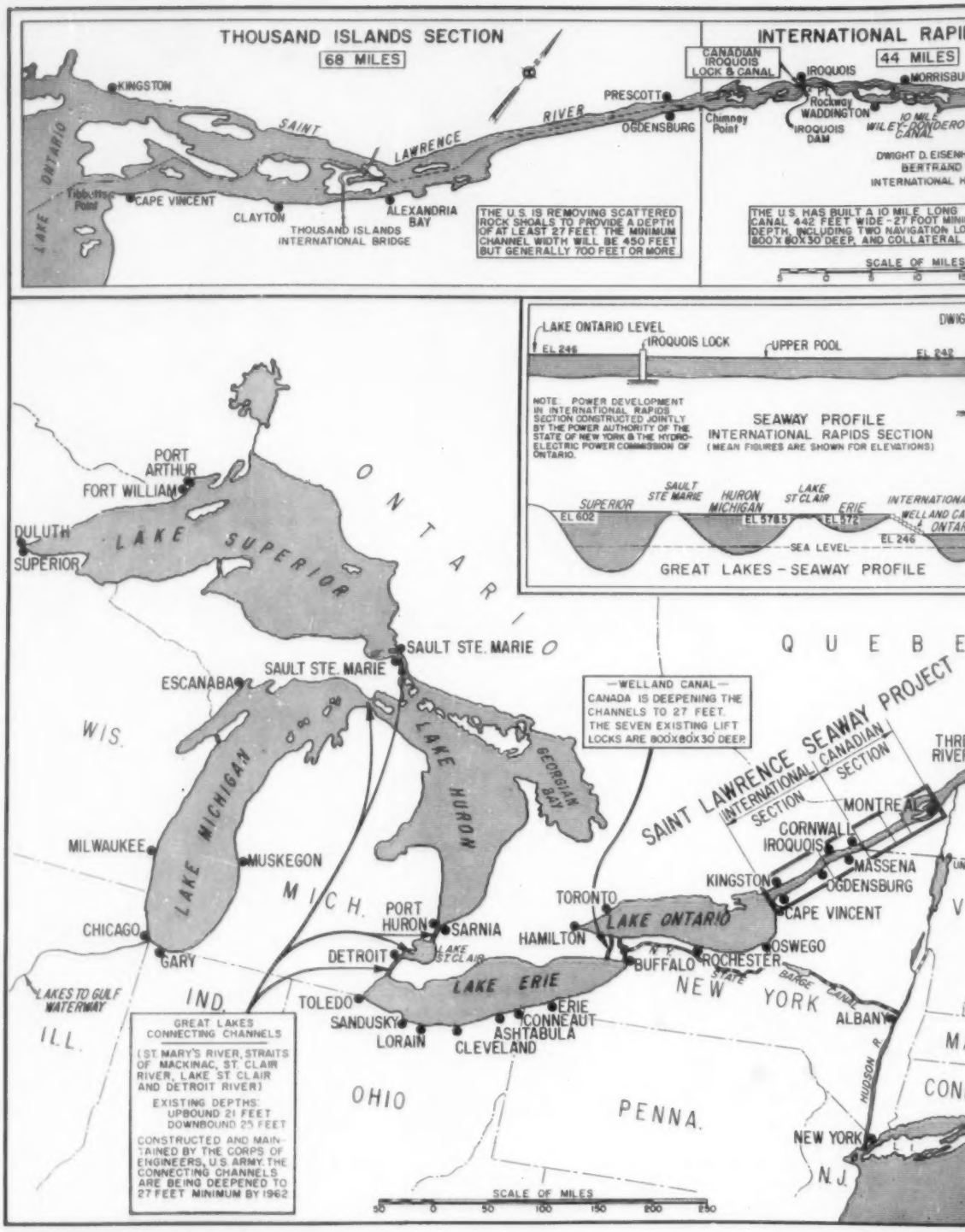
The Connecting Channels

The Great Lakes Connecting Channels, generally referred to as the Connecting Channels, include the waterways between Lakes Superior and Huron, Lakes Huron and Michigan, and Lakes Huron and

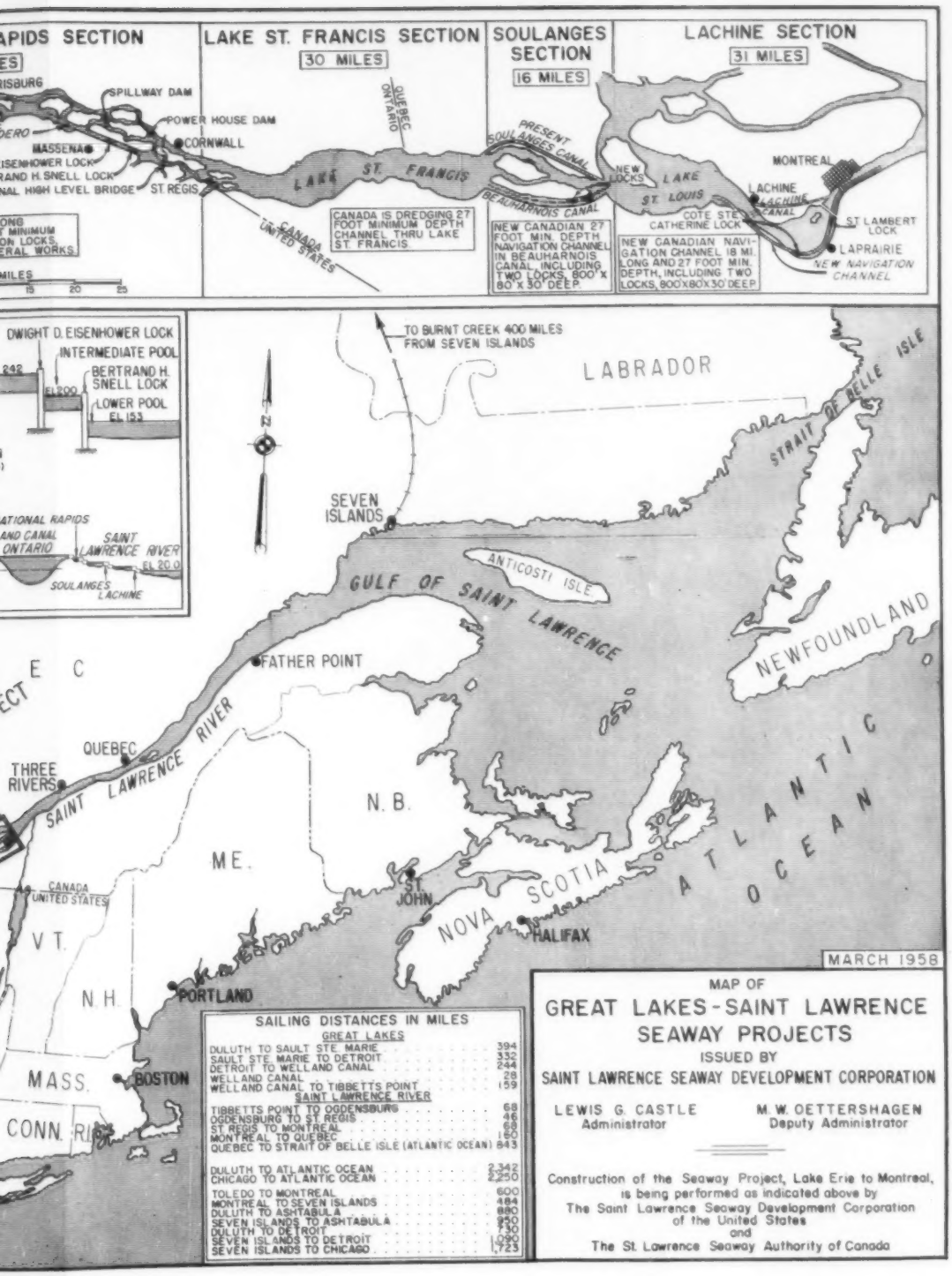


Army U S Lake Survey Detroit Litho. (Revised Jan 1957)


NOTE
GREAT LAKES CONNECTING CHANNELS now being deepened from 21 feet in upbound channels and 25 feet in downbound channels to minimum depth of 27 feet in upbound and downbound channels as authorized in 1956.
ST. LAWRENCE RIVER above Montreal being improved to provide increased depth from 14 feet to minimum depth of 27 feet. ST. LAWRENCE RIVER below Montreal now deepened to 35 feet.
WELLAND CANAL being deepened from 25 feet to 27 feet.
LEGEND
IMPROVED HARBORS
FEDERAL
PRIVATE
PROJECT DEPTH
26 FEET
25 FEET
22-24 FEET
18-21 FEET
SAULT STE. MARIE
ST. MARYS RIVER
(See Note)
STRAITS OF MACKINAC
POE REEF
CALCITE
ALPENA
LAKE HURON
HARBOR BEACH
BAY CITY
SAGINAW
BLACK RIVER
PORT HURON
ST. CLAIR RIVER
DETROIT
ROUGE RIVER
LAKE ST. CLAIR
DETROIT RIVER
(See Note)
CHANNEL
MONROE
TOLEDO
SANDUSKY
HURON
LORAIN
CLEVELAND
FAIRPORT
ASHTABULA
CONNEAUT
ERIE
LAKE ERIE
PENNSYLVANIA
OHIO
TORONTO
HAMILTON
LAKE ONTARIO
NIAGARA RIVER
(See Note)
WELLAND CANAL
(CANADIAN)
BLACK ROCK
CHANNEL
BUFFALO
OSWEGO
GREAT SODUS
ROCHESTER
NEW YORK STATE BARGE CANAL
MONTREAL
ST. LAWRENCE RIVER
INTERNATIONAL BOUNDARY
OGDENSBURG
INTERNATIONAL RAPIDS SECTION
(See Note)
CANADIAN 14 NAVIGATION PROJECT
ST. LAWRENCE SEAWAY TO THE SEA
CHAMPLAIN CANAL
GREAT LAKES DEEP-DRAFT HARBORS
U. S. ARMY
CORPS OF ENGINEERS
NORTH CENTRAL DIVISION
15 OCTOBER 1956
SCALE OF MILES
50 0 50 100



Army U.S. Lake Survey Detroit-Litho 1958



SAILING DISTANCES IN MILES

GREAT LAKES	
DULUTH TO SAULT STE. MARIE	394
SAULT STE. MARIE TO DETROIT	332
DETROIT TO WELLAND CANAL	244
WELLAND CANAL	28
WELLAND CANAL TO TIBBETTS POINT	159
SAINT LAWRENCE RIVER	
TIBBETTS POINT TO OGDENSBURG	68
OGDENSBURG TO ST REGIS	46
ST REGIS TO MONTREAL	68
MONTREAL TO QUEBEC	180
QUEBEC TO STRAIT OF BELLE ISLE (ATLANTIC OCEAN)	843
DULUTH TO ATLANTIC OCEAN	2,342
CHICAGO TO ATLANTIC OCEAN	2,250
TOLEDO TO MONTREAL	600
MONTREAL TO SEVEN ISLANDS	484
DULUTH TO ASHTABULA	880
SEVEN ISLANDS TO ASHTABULA	950
DULUTH TO DETROIT	730
SEVEN ISLANDS TO DETROIT	1,090
SEVEN ISLANDS TO CHICAGO	1,723

MAP OF

GREAT LAKES - SAINT LAWRENCE SEAWAY PROJECTS

ISSUED BY

SAINT LAWRENCE SEAWAY DEVELOPMENT CORPORATION

LEWIS G. CASTLE
Administrator

M. W. OETTERSHAGEN
Deputy Administrator

Construction of the Seaway Project, Lake Erie to Montreal, is being performed as indicated above by The Saint Lawrence Seaway Development Corporation of the United States and The St. Lawrence Seaway Authority of Canada

Erie. The St. Marys River, including the shoal approach to the head of the river, is the connecting channel between Lake Superior and Lake Huron. The Straits of Mackinac and approaches thereto comprise the connecting channel between Lake Huron and Lake Michigan. The St. Clair River, Lake St. Clair and the Detroit River, with the approaches in Lake Huron to the head of the St. Clair River and Lake Erie to the mouth of the Detroit River, comprise the connecting channel between Lake Huron and Lake Erie.

The international boundary between Canada and the United States passes through all of the Great Lakes and their connecting channels, except Lake Michigan which is wholly within the United States.

Although the lakes are deep, the connecting rivers had shallow reaches in their original state and over the years it was necessary to dredge these channels to provide adequate depths to accommodate deep-draft lake vessels. In addition, the St. Marys Falls in the St. Marys River at Sault Ste. Marie were impassable and locks were required to overcome the drop at the Falls to permit vessels to pass between Lakes Superior and Huron.

At the present time controlling depths of 25 feet in downbound channels and 21 feet in upbound channels, when the ruling lake level is at low water datum, are available between Lake Superior and the lower lakes. The greater depths were provided in the downbound channels to accommodate deep-draft loaded ore carriers.

In addition to the channel improvements, four locks (the Poe, Davis, Sabin and MacArthur) and two approach canals have been constructed in the St. Marys River at Sault Ste. Marie. One of the locks, the MacArthur lock, is equal in size to the St. Lawrence Seaway locks and can accommodate any vessel which can pass through the Seaway. Congress has authorized construction of a new modern Poe Lock with a depth over the lower still of 32 feet to replace the existing Poe Lock. This additional large deep-draft lock is required for the considerable Great Lakes traffic which cannot pass through the two older locks with depths over their sills of only 23 feet.

Traffic between Lake Ontario and Lake Erie is through the Canadian Welland Canal which has locks adequate for modern deep-draft navigation and has been deepened to 27 feet as part of the 27-foot Saint Lawrence Seaway from Montreal to Lake Erie. However, the connecting channels between the lakes west of Lake Erie require deepening to accommodate the increasing number of larger, faster and more economical vessels in the Great Lakes fleet as well as the deep-draft traffic through the St. Lawrence Seaway.

The Channels Project

The project for deepening the Connecting Channels to 27 feet was initiated in May, 1957. It is primarily a large-scale underwater excavation job, embracing the removal of about 64,000,000 cubic yards of earth and rock. It requires the mobilization and deployment of one of the largest and most varied fleets of dredging equipment ever assembled, and exceeds by far, any previous undertaking of this kind during the 133-year experience of the U. S. Army Corps of Engineers on the Great Lakes.

When completed in 1964, this project will have cost approximately $146.5 million, but it is estimated that savings of almost $10 million in three commodities alone—iron ore, stone and grain—will be made annually in transportation costs. Details of the work are as follows:

St. Marys River—deepen 63 miles of channel, varying in width from 300 to 1,500 ft., to depths varying from 27 to 30 ft.; remove isolated shoals: construct anchorage areas at Point Iroquois Shoal 29 ft. deep and in Lake Nicolet 28 ft. deep.

Straits of Mackinac — remove shoals over an area 4,000 by 1,250 ft. between Mackinac Island and Round Island to a depth of 30 ft. and removal of Poe Reef Shoal to a 30-ft. depth.

St. Clair River—deepen 46 miles of river channel, varying in width from 700 to 1,400 ft. to depths varying from 27 to 30 ft.; included in this phase of work is a cutoff channel at Southeast Bend in the St. Clair River which will be 6 miles long, 700 ft. wide and 27 ft. deep, eliminating the use of the present hazardous Southeast Bend Channel.

Lake St. Clair—deepen 17 miles of channel, varying in width from 700 to 800 ft., to 27.5 ft.

Detroit River—deepen 32 miles of river channels, varying in widths from 300 to 1,200 ft., and in depths from 27.5 to 29 ft.; deepen channel extending 9 miles into Lake Erie from the Detroit River light to 28.5 ft. over a width of 1,200 ft.; remove Pelee Island Shoal to 28.5 ft. depth.

The dredging job is complicated by the constant stream of lake vessels—one every 15 to 20 minutes day and night during the height of the navigation season — that pass through the Connecting Channels during construction. This traffic is stopped or slowed down only when navigation is hazardous because of fog, storm or accident. For example, during a navigation season, some 30,000 vessels pass through Detroit River channels. Because of this heavy traffic which cannot be stopped, the dredging work must be done in half-channel widths with normal vessel traffic proceeding at reduced speeds in work areas. Work is carried on continuously except for the winter months when ice conditions require layup of floating plant.

Concurrently with the Connecting Channels project, the U. S. Army, Corps of Engineers is also improving Chicago's Calumet-Sag channel to provide an adequate and modern connection between the Mississippi River and Lake Michigan via the Illinois Waterway. This 327-mile long barge waterway links the Great Lakes with the barge system of the Mississippi and Ohio Rivers. U. S. Army Engineers are widening the "Cal-Sag" from 60 feet to 225 feet, with a 9-foot depth.

Further Studies Underway

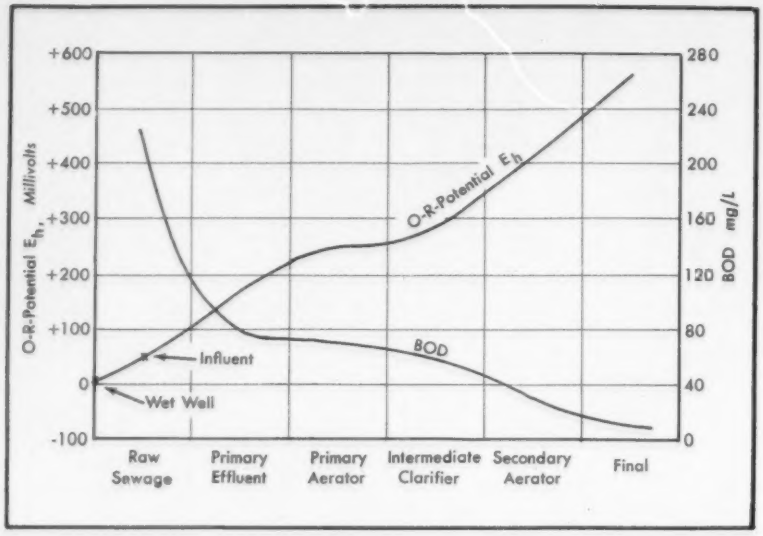
The need for improvements at harbors on the Great Lakes to accommodate the large, deep-draft vessels which will transit the deeper channels has been recognized. The U. S. Congress has directed the Army Corps of Engineers to make a study to determine the advisability of further improvements of harbors on the Great Lakes in the interest of present and prospective deep-draft commerce. In determining whether improvements can be justified at Great Lakes harbors three major elements are studied: Prospective traffic, engineering design and economic analysis. Every improvement must be a sound investment.

This study is now in progress. Separate interim reports are being prepared on numerous individual harbors and certain bulk commodities. When completed the results of these studies will be reported to Congress for authorization and subsequent appropriation of funds.

The information on which this article is based was supplied by the Saint Lawrence Seaway Development Corporation, Massena, N. Y., and the U. S. Army Corps of Engineers, North Central Division, Chicago. The color and black and white separations from which the accompanying maps were made were furnished us through the courtesy of the U. S. Engineer Division, North Central, Chicago, Ill.

● **CONTACT** aeration plant, above, consists of two identical complete units designed for flows of 300,000 gpd each.

● **OPERATING** results, right, show BOD and ORP at six stages through the treatment plant units. Details in text.



OPERATION OF A CONTACT AERATION PLANT

GUENTER SPOHR, Superintendent of Sewerage District #1, Lake Hiawatha, New Jersey

● **SEWERS** have relatively flat grades and preventive program of cleaning and flushing has eliminated most troubles.

THE LAKE Hiawatha Sewage Treatment Plant which utilizes contact aeration has shown successful results throughout the last year and a half, in spite of adverse conditions. During the year 1958, the average daily flow of about 270,000 gallons came from a contributory population of 5500. This is equivalent to 49 gpcd. The New Jersey State Dept. of Health has set the acceptable minimum for use in sewage treatment plant design at 100 gpcd. The water consumption rate for the Middle Atlantic States has been estimated at 137 gpcd. These figures show that the flow in the collecting system of the Sewerage District #1, with its 16 miles of sewer lines, is low in velocity and produces a stale septic sewage arriving at the plant.

The plant consists of two identical complete treatment units, each designed for 0.3 mgd. The raw sewage, 60 percent of which flows by gravity enters the plant through a hand-raked bar screen and is distributed by means of open channels to the two primary settling tanks. An American Well Works sludge collector is employed. The primary sludge is transferred manually or automatically to the P.F.T.-equipped unheated digester. These rectangular primary settling tanks provide an approximate detention time of 2.5 hours. All the recycled sludge from the other tanks is settled out in the primary tanks.

The BOD loading of the aeration tank is based on an average sewage flow of 100 gpcd. and 200 mg/L BOD. For each 8 pounds of the total daily BOD load, 1000 square feet of contact area of asbestos cement panels are provided.

The first aerators receive 60 to 70 percent of the available air supply from Sutorbilt blowers for the carbonaceous oxidation, with the remaining 30 to 40 percent going to the second stage aeration units. The intermediate settling tanks handle the constant sloughing from the bioplates of the first aerators. The sludge is returned by means of air lift pumps to the primary settling tanks. The final settling tanks function also as chlorine contact tanks with ample detention times for the chlorine.

A flowmeter is installed to record and transmit both final effluent flows to the control building.

We have found that without continual attention, odors resulting from septic inflow will be produced. A good functional laboratory to provide the necessary data for changes in operation, clean housekeeping, and good maintenance have to be employed to overcome these problems.

The rapid photometric estimation of the BOD as plant efficiency indi-

cator is done by a photometer with a 420 mμ or 4,200° Angstrom filter. Frequent checking of the curve by the conventional 5-day BOD dilution method results in a close correlation. Supplementary analyses with the photometer are done for ammonia nitrogen, nitrate nitrogen and hydrogen sulfide determinations.

For the period, January, 1958, to May, 1959, average operating results for the digesters showed a pH of 6.9; volatile solids, 278 mg/L; total solids, 7.97 percent; volatile solids, 47.5 percent; alkalinity, 2,840 mg/L; total acidity, 510 mg/L; ORP E_h,—70 millivolts; and temperature, 57°F.

Use of ORP

Oxidation - reduction potential, termed ORP, is another analytical tool used to maintain a high efficiency and to combat odors. It has been stated that odor-producing organisms are found in the zone of zero ORP. The aim is therefore to have high potential values throughout the aerobic process. Earlier investigations combined ORP values with the ecological classifications of Kolkwitz and Marsson. A revised saprobian system for more specific classification is now being used. In this new classification concept, more emphasis should be given to "cosmopolitan" protozoa as universal indicators regardless of geographical location.

The ORP survey in conjunction with the BOD removal demonstrated the intensity level of the various oxidation stages. Therefore, in summertime, with a high oxygen demand, optimum conditions have to be maintained. In our operation, two blowers provide the necessary air requirements continuously for three-fourths of each day. Another beneficial factor is the constant recirculation of the final chlorinated effluent with a high chlorine residual of 1 mg/L and the maintenance of the desired overflow rate. This recirculation from the final settling tanks and the secondary aerator provides a higher BOD removal in the primary settling tanks than anticipated.

One of the important factors in contact aeration is the removal of the excess biological growth on the bio-plates by "blowing". Each section of the aeration tanks gets the full amount of the available air for half an hour. At temperatures above 90°F, three blowings per weeks are necessary to remove the right amount of zoogloea from the plates. The recovery from the blowing, which produces negative ORP values, is rather rapid, but for two or three hours a higher BOD load and a higher amount of suspended solids is carried over to the final tanks.

Samples of the recycled sludge obtained from the "cleaned" bioplates were taken and bacteriological slides prepared for differentiation under the microscope. *Zoogloea ramigera* rods were found in the slime balls and these were classified poly-alpha-mesosaprobic. Various protozoa, Paramecium, Putrinum, *Colpidium colpoda,* and *Glaucoma scintillans* could be observed.

For help in odor control, an orthodichlorobenzene compound made by National Disinfectant Co. is introduced in the influent. Rhodia is fed into the aeration tanks.

Digester Operation

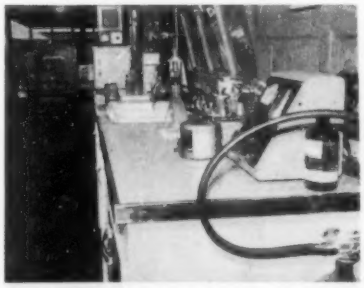
The time required to digest sewage sludge varies with the temperature. For the Lake Hiawatha digester (unheated), with a 206,000-gal. holding capacity, 70 days are required in the winter and 50 days in summer for detention time to produce a stable, non-offensive, well-digested sludge. Obviously, better results would be obtained if the structure were heated.

Average results for 1958 showed BOD reductions from a raw sewage figure of 207 mg/L to 14 mg/L in the final effluent. Corresponding results for suspended solids were 274 mg/L and 17 mg/L, respectively. Bionetic is used for control of scum formation in the digester.

The sludge drying beds of the Lake Hiawatha sewage treatment plant cover an area of 9000 sq. ft. of which 2500 sq. ft. are covered with a glass enclosure made by World Wide Greenhouse Corp. of Lake Hiawatha.

Flushing Program

Due to the long flat graded trunk lines and low water consumption causing low velocities, flushing of the lines plays an essential part in the sewage treatment plant operation. Chlorinated effluent is hauled in a 1200 gallon converted oil truck and flushed through the entire collecting system. Two automatic flush tanks provide a better flow at strategically located points in the system.



● **SECTION of laboratory showing some of equipment used. Membrane filter has been employed for effluent tests.**

Sewer line cleaning is another important function of the plant operation. This preventive program of cleaning and maintenance results in a better flow in the lines and sewer characteristics are now more amenable to the biological process in the plant itself. Therefore, the Commissioners of Sewage District #1 authorized the purchase of the necessary equipment to do this job. One special feature is the use of a Jeep truck with a "power take-off" to run the sewer cleaning winches. Except for the truck and power take off, sewer cleaning equipment used by the district is made by W. H. Stewart.

Bacteriological Testing

The quality of the final effluent in view of coliform-density values is determined by a Coli-5 membrane filter apparatus. Samples range from 10 to 50 ml per test. The single-step M-Endo broth is used and yields good results in 18 hours.

The use of the membrane filter for final effluent analyses was encouraged by the New Jersey State Department of Health with the comment that with continued research, the use of the membrane filter technique will ultimately gain full acceptance by those in the waste treatment field.

Appreciation is expressed to the Commissioners of Sewerage District #1 and the plant personnel for their active support. Thanks also go to the authors whose articles or books are cited.

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SNOW AND ICE CONTROL in the DISTRICT of COLUMBIA

WILLIAM A. XANTEN,
Superintendent, Division of Sanitation, Washington, D. C.

THE SNOW program of the Washington, D. C. Engineering Department comprises the plowing of snow from main thoroughfares and boulevards (342 miles of streets); the physical removal of the snow (by hauling) from the major business areas only (approximately 33 miles of streets); the progressive opening of crosswalks, catch basins and fire hydrants; and spreading abrasives and chemicals on the more important hills and intersections. The combined forces of the Sanitary Engineering Department and the Highway Department are used on this work, supplemented by a considerable number of hired trucks. Expenditures under this program, depending on the severity of the winter, can vary from $200,000 to $600,000 or more annually, based on the limitation of available funds. The major cost of the snow program is for spreading abrasives and chemicals and hauling snow from some 33 miles of business streets, principally in the heart of the downtown area but including several outlying business districts, bridges and important intersections.

The plowing program is confined to approximately 342 miles of arterial and heavily-travelled streets. This is a task of greater magnitude than is expressed by the linear mileage, and all available equipment (160 plows) must be assigned to these important thoroughfares for the duration of the storm.

The necessity of plowing from two to four or more lanes of traffic each way on the wide streets of this city, in addition to the replowing of those lanes as snow continues to fall, would perhaps argue for an expression such as "plow miles" rather than "miles" of streets, in order to present a more understandable picture of the task involved. In other words, the 342 miles of streets on the plowing schedules require plows to travel in excess of 2500 miles to clear the entire roadway once. In the event of a 10-in. snow falling at the rate of 1-in. per hour, and based on the estimate that each route is covered once every two hours, it would be necessary for the plows to travel an aggregate of 12,500 miles during the ten-hour period of the snow fall in order to keep open the entire width of the 342 miles of streets regularly scheduled for plowing.

Plows are started upon the accumulation of as little as a 2-in. depth and must be operated continuously during the snow storm to combat, as much as possible, the packing of snow by the heavy city traffic. Firmly packed snow is difficult to scrape off, and when turned to ice cannot readily be removed by mechanical means.

Emergency Plowing Program

The emergency plowing program for snows over 12 in. is confined to 122 miles of arterial highways. This program is set up in the event of a heavy snow, and all available plowing equipment will be concentrated on these particular highways to attempt to keep the roadways open for emergency vehicles to provide coal, fuel oil, food, medical treatment, etc., to residents of the District. After snow has stopped falling and the emergency routes are completed, efforts are made to deal with the regular plow routes. Heavy windrows at important intersections have to be given special attention.

The complete removal of snow by loading and hauling in trucks (and disposing of it into sewer manholes and the river) is confined to 33 miles of streets in the downtown and outlying business districts. By the use of all available District labor and equipment, supplemented with extra labor and trucks, the program contemplates a force consisting of 1500 men, 375 trucks, and available mechanical loaders (now numbering 35) working mainly during the traffic-free hours during the night and for a number of shifts depending on the depth and severity of the snow storm.

Some idea of the amount of work involved may be gathered from the following example of a 10-in. snow storm. This would deposit a volume of snow on streets scheduled for hauling amounting to 470,000 cubic yards or 94,000 truck-loads. It is estimated that such a storm would require these snow hauling forces to be engaged for six shifts and the cost for this phase of the program alone would amount to approximately $150,000. Hauling snow from any large mileage of streets, therefore, is seen to be both financially and physically prohibitive.

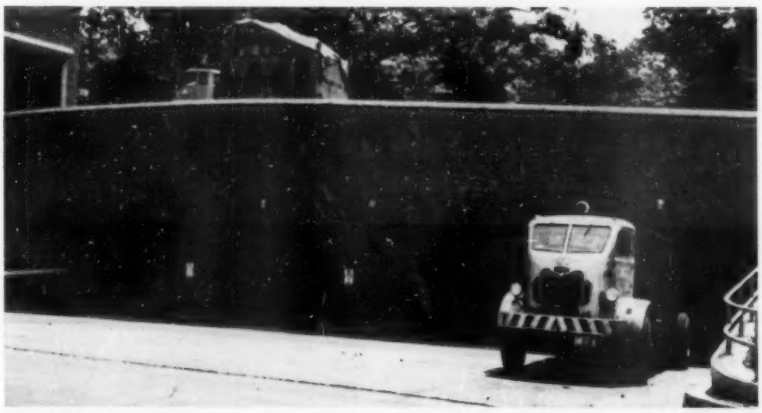
As part of the snow hauling program the regular white wing forces (numbering some 375 men) are assigned to improve conditions in their respective areas throughout the city by stationing sand crews on important hills; clearing snow from crosswalks, catch basins, fire hydrants; and clearing and hauling snow from important intersections, bridges, and necessary places, to the extent that it is possible by spreading their limited forces over the approximate 1100 miles of streets. These forces are also supplemented by extra hired men after the need for extra labor for supplementing the hauling has been satisfied.

Sanding Program

Sanding equipment proceeds over scheduled routes of streets selected in consideration of the presence of hills and the volume of traffic. In recent years the sanding program has been supplemented by placing some 500 sand cans at strategic locations throughout the city for voluntary use. Special sand crews are also stationed on the more critical hills to assist traffic during daylight hours. In addition to scheduled

● **THIS is a typical rotary snow plow unit. It is used for fast loading of trucks in areas where snow must be hauled away and for drifts on bridges and main streets.**

● **FRONT-END loader is used for several purposes, including loading salt into spreader trucks, as shown here, and for loading snow into trucks for hauling away.**



● **SALT storage hoppers are provided under the ramp at the Mount Olivet incinerator. These have a capacity of 120 tons and permit quick loading of trucks with salt.**

routes, requests for special sanding are responded to as promptly as available forces permit. This request service is maintained 24 hours a day during freezing weather.

In addition to the sanding program of the District Government, the D. C. Transit System operates an equally important sanding program over their bus routes. Therefore, in order to cover as much territory as possible, the District does not schedule streets on bus routes for sanding by its forces. It is also pointed out that the U. S. Park Service maintains a force for sanding roads within the park area. U. S. Engineers at Dalecarlia Reservoir also maintain a force for sanding in that area.

The District's snow regulation contains four plans which may be put into effect by the Director of Vehicles and Traffic under certain conditions. The plans are:

1) Declaration that a state of traffic emergency exists because snow, sleet, or freezing rain is causing slippery or hazardous conditions which may lead to serious traffic congestion on District streets. During the traffic emergency, operators of all vehicles which are not equipped with effective skid chains or effective snow-tread tires are warned that they are subject to arrest if their vehicles stall so as to obstruct traffic on any of the 85 main streets.

2) Request for the early dismissal of Federal and District employees at a specific time in advance of their regular closing schedule when there is a firm forecast of bad weather.

3) Issuance of a general warning to motorists that non-essential motor trips be cancelled in view of a forecast of bad weather.

4) Declaration of a parking emergency prohibiting parking on any of the 85 major arterial streets from midnight until 7 am when there is a firm forecast that snow is expected to fall between the hours of 7 pm and 7 am. The 85 major arterial streets are marked by a broad yellow band painted around the first lamp post on the right at the beginning of each block.

Printed announcements of these four plans have been distributed to the newspaper, television and radio stations, and police departments in the Washington metropolitan area.

If the Director of Vehicles and Traffic declares a state of traffic emergency, or requests the early release of government employees, or issues a general warning to motorists, or declares a parking emergency, area police departments,

newspapers, radio and television stations will be notified immediately in order that they may issue this news to the public.

The plowing of residential streets is undertaken as a secondary program only in outlying areas and in special cases, because there is a serious question of the desirability of plowing the relatively narrow residential streets with parked cars on either side, since this is frequently followed by criticism and demands for hauling of snow from around parked cars and driveway entrances, crosswalks, etc. Also, upon the conclusion of plowing arterial streets, most of the equipment operators and other forces are needed for the snow hauling program and are so assigned after a minimum interval of rest.

To haul snow from the entire 1,100 miles of streets in the city at large would require an expenditure and a program more than 30 times as great as the present program. In addition to the expenditure, the number of trucks and labor needed for such increased work would not be available. Snow disposal stations, the supervisory forces and other facilities would have to be expanded in like proportion. From this it may be seen why the practice in virtually all large American cities is to remove snow only from congested areas. It is not believed that the expenditures necessary to accomplish hauling snow from residential streets, private driveway entrances, from around snowed-in parked automobiles and other special hauling not contemplated under the present program, are warranted. Nor is it believed that an informed public would support the enormous expenditures required for such work. This statement is based upon the recognized limitations of any snow hauling program and the universal practice in other cities.

Plowing cannot be stopped when a parked automobile is encountered or a driveway is approached, as this would leave a windrow of snow greater than the width of the plow extending out into the street causing a traffic obstruction and hazard.

Sidewalk Cleaning

Generally, no sidewalk cleaning is undertaken by the city, with the exception of limited areas in business sections from which snow is scheduled for hauling for accommodations of the general public, from bridges, and from sidewalks cleaned by the U. S. Park Service around public parks and buildings. It is physically impossible for the city to undertake to remove snow from the approximate 2,000 miles of sidewalks in the city, when all available forces are engaged on sanding, plowing and hauling from a limited mileage of streets in the city.

Alleys are not plowed for several reasons. The bulk or size of the plowing equipment when fitted with plow blades makes it impossible to negotiate most alleys. Basically, a snow plow is a displacement device and must have a suitable marginal strip along the lane to be plowed to receive the resultant windrow of snow. In alleys there is no such space, generally.

In emergency operations it is essential to have a well-controlled and organized force of experienced laborers and equipment operators, together with their foreman, for prompt and dependable work. The snow program requires the use of the personnel and truck equipment of the Street Cleaning, Refuse, Highway, Sewer and Water Divisions as the main source of snow fighters; extra men and trucks are engaged as necessary and when available. This is standard practice in all American cities. As soon as possible following the conclusion of snow removal assignments, refuse collection forces are ordered back to collection routes. This requires working overtime, including Saturday and Sunday work in order to overcome the disruption in refuse collections.

Sodium or calcium chloride is not used as heavily in Washington as in other cities to combat icy conditions because its use results in the short-circuiting of the underground third rail of the transit system. This material is used, however, on outlying streets sufficiently remote from the underground third rail to assure no salt solution will be tracked ahead to give trouble.

Flushing or hosing of snow and slush off the streets is not attempted because the drainage system of Washington is equipped with trapped catch basins which, being designed to hold solids and prevent their entry into the sewer, (as well as to prevent the escape of sewer gases), quickly fill up with slush and become clogged. Direct sewer inlets exist in some cities, and when temperatures are favorable the very satisfactory flushing method is utilized.

Snow is disposed of by dumping it into manholes, some of which have been specially constructed for snow disposal, directly over active, flowing sewers; by dumping into the river; and by dumping on city dumps.

Use of Brooms

Revolving brooms mounted on automotive units are used to some extent in a few cities where a full complement of snow equipment is owned. For very light, dry snows, such as cannot effectively be skinned off by the plows, these brooms are of service but their effectiveness depends upon the ability to sweep off the snow before traffic packs it. Consequently, it would be necessary to purchase a large number of such brooms in order to sweep the city's arteries in event of light snowstorms. It is believed that available funds are better applied to the purchase of equipment for heavy storms.

Streets are sanded in conjunction with plowing operations. However, during a heavy fall of snow the use of abrasives is not as effective as would be the use of either sodium or calcium chloride. An average of 20 days annually occur when slippery roadway conditions occur.

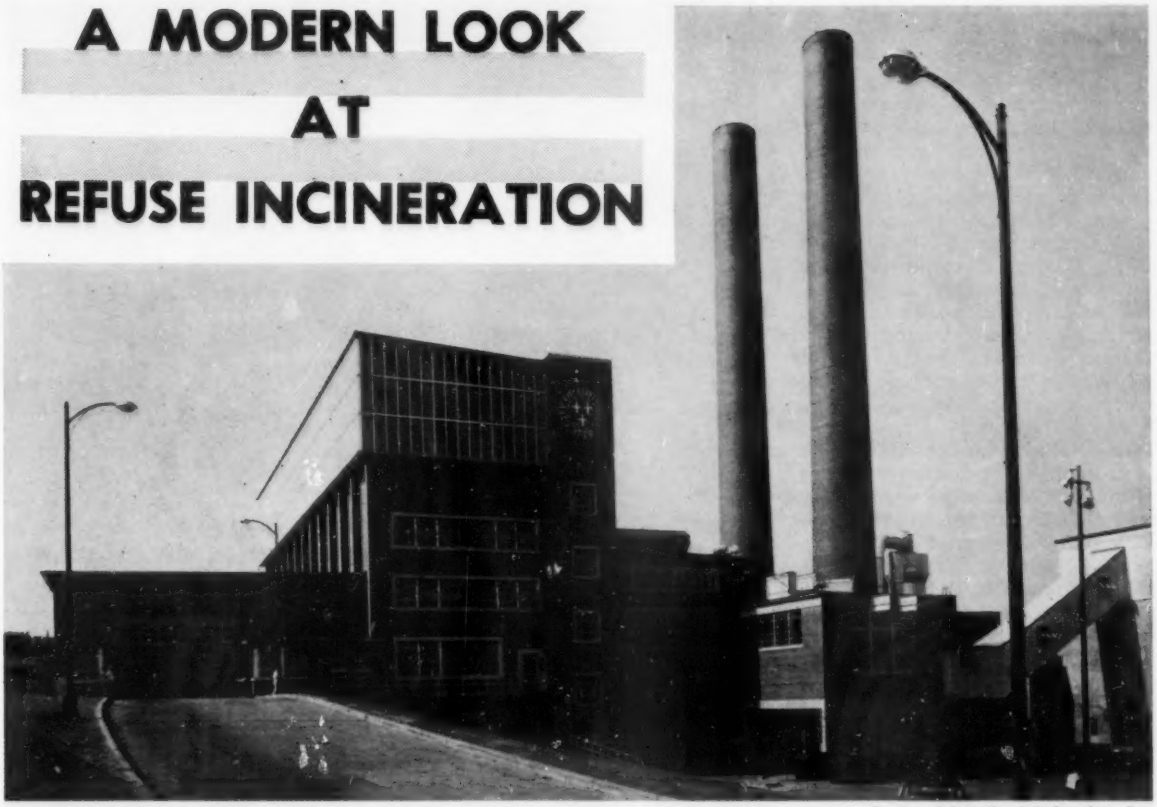
Thousands of tons of sand (approximately 16,000 tons during the 1957-1958 winter) are spread on the streets during the winter and every effort is made to remove the sand as rapidly as possible by the regular street cleaning forces. Because of the large quantities used, however, the winter-time street cleaning frequency coverage is seriously affected.

Also, most of the abrasive qualities of the sand are lost after once being used; because of its low cost ($1.60 per ton), there would be little economy in recovery.

In the past 59 years, snow in measurable amounts has fallen on 559 occasions, or about 10 times a year. Of these, there were 179 snow storms of a depth 2 in. and over, averaging approximately three a year. In some years virtually no snow has fallen and in other years as many as eight heavy storms have occurred. The average annual snowfall is 19.3 inches. During the 1957-58 season, 40.4 in. of snow fell. In the season of 1930-31, only 2½ in. fell. In the season 1921-22, 44½ in. of snow fell, including the 26-in. storm of January 27, 1922, the greatest locally since 1899.

The task of enabling vehicular and pedestrian traffic to continue moving normally during and after a snow storm is a huge task and one which, even at large and unreasonable expenditure, cannot be totally accomplished for lack of sufficient equipment and man power.

A MODERN LOOK AT REFUSE INCINERATION



Courtesy International Incinerators, Inc.

● IN THE Louisville incinerator the area enclosing the crane and storage pit is corrugated glass for maximum lighting.

LeROY W. VAN KLEECK,
Principal Sanitary Engineer,
Connecticut State Department of Health

NOT MANY years ago refuse incinerators were considered no more than a brick box filled with refuse to which a match was applied. Many communities did not worry about smoke, fly ash, poorly burned refuse or other nuisances attending the operation; and, in fact, some designs permitted little control of adverse conditions. Modern design and intelligent operation by trained personnel have shown municipalities that incinerators can burn mixed refuse without nuisance in conformity with air pollution ordinances, and thus provide a sanitary facility of which a community may be proud. This article takes a modern look at refuse incineration and pinpoints its present trends in design and operation.

Among the reasons for the growing trend to refuse incineration are:

1) Land areas for dumping refuse on the surface of the ground or for a sanitary landfill operation are becoming more and more scarce in built-up communities, and even though land areas are available the refuse hauling distance may be excessive. Furthermore, in the case of open dumps, they are nuisances from insect breeding, rodent harborage, odors, smoke and unsightliness; sometimes causing pollution.

2) Hog farms are becoming less popular because of nuisance and the need for cooking garbage to control vesicular exanthema among swine and to prevent trichinosis in humans. Cooking garbage has discouraged some pig owners from feeding garbage, thus leaving the problem of its disposal to the community affected. In any event, feeding of garbage to hogs still leaves the problem of rubbish disposal.

3) Since suitable refuse disposal areas are becoming scarce in built-up communities, incineration offers an attractive solution to the conservation of existing sites. Changes in location of refuse disposal areas usually meet with strong public opposition, whether or not such objection is warranted. Even efficient incineration produces ash, and space must be available at a dump for disposing of this ash, together with those materials that cannot be incinerated. Many communities could further conserve ash dumping space by flattening cans with a bulldozer, at the same time preventing mosquito breeding in the water accumulating in unflattened cans.

Changes in Refuse

The composition of the average municipal refuse not long ago was 65 percent garbage and 35 percent rubbish by weight. Today, the picture is more than reversed; garbage is running only 15 to 20 percent by weight of total refuse in many communities. The use of home garbage grinders and the increasing use of frozen or canned vegetables, or pre-packaged fresh vegetables with little waste, have been important influences in this reversal. Furthermore, the public is buying more goods and these goods usually come wrapped in ever increasing quantities of paper and cardboard boxes. Thus rubbish quantities are increasing. These changes in the character of refuse result in:

1) A drier refuse mixture.

2) A higher available BTU value per lb. of refuse.

3) Increased weight of refuse per capita per day.

4) Increased volume of refuse per ton of weight.

How do these changes affect incinerator design and operation? Plenty! To wit:

1) Drier refuse with more available BTUs per pound requires controls for preventing too high temperatures. No longer are preheaters needed but rather over-fire cooling air. Damper doors, manually or automatically controlled, above the grates in the ignition chambers or in the combustion chambers supply this requirement.

2) Incinerator capacities must be rated higher, when designed on a per capita basis. Whereas 1 ton of refuse per 1000 persons per day was considered a satisfactory allowance a few years ago, 1½ tons is conservative design today, and some industrial communities require a capacity of 2 or more tons per 1000 persons per day. Furthermore, if burning is planned for only 8 hours of the day, the rated daily capacity must be three times the figure calculated for 24-hour operation.

3) The increased volume of refuse (about 5 cu. yds. per ton on the average) requires larger furnace volumes than formerly. The volume capacity of the ignition chambers is thus often more critical than their grate areas. It is this writer's opinion that present-day furnace volumes, exclusive of the combustion chamber volumes, should approach 15 cu. ft. per ton of refuse burned per 24 hours with grate loadings not exceeding 70 lbs. of refuse per sq. ft. of grate per hour, and preferably reduced to near 60 lbs.

Handling and Burning

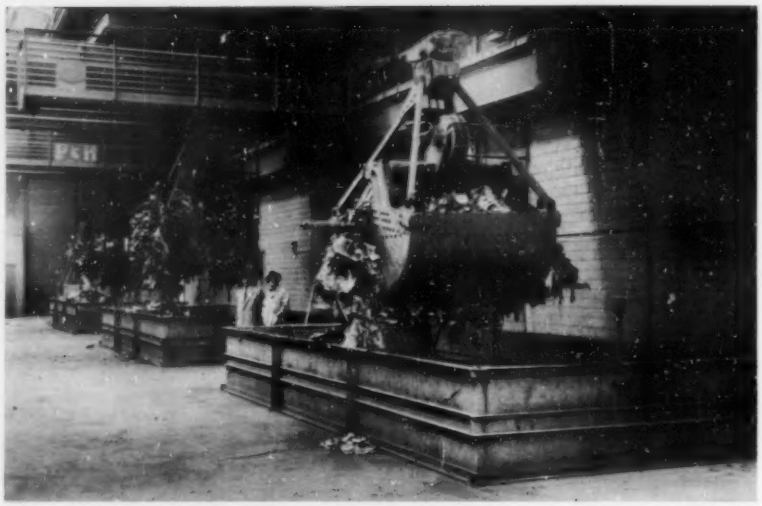
A trip through a modern incineration plant reveals many improvements over the older designs. Let us start with the arriving refuse trucks:

Storage, Handling and Charging of Refuse. Floor storage, as used in many of the older incineration plants, is unsightly, is often unsanitary and usually results in poor firing. With floor storage, there is always the tendency, especially at small plants, to permit the trucks to dump directly into the furnaces. This results in overloading and smoking, then high temperatures followed by burning down and low temperatures. Refractory maintenance is high when this method of operation is employed.

Mixing of dry and wet refuse is difficult with floor dumps unless the area is large and a bulldozer can be used. Grease on the floor is a hazard to the charging operators many of whom fail to use safety belts even when such facilities are provided.

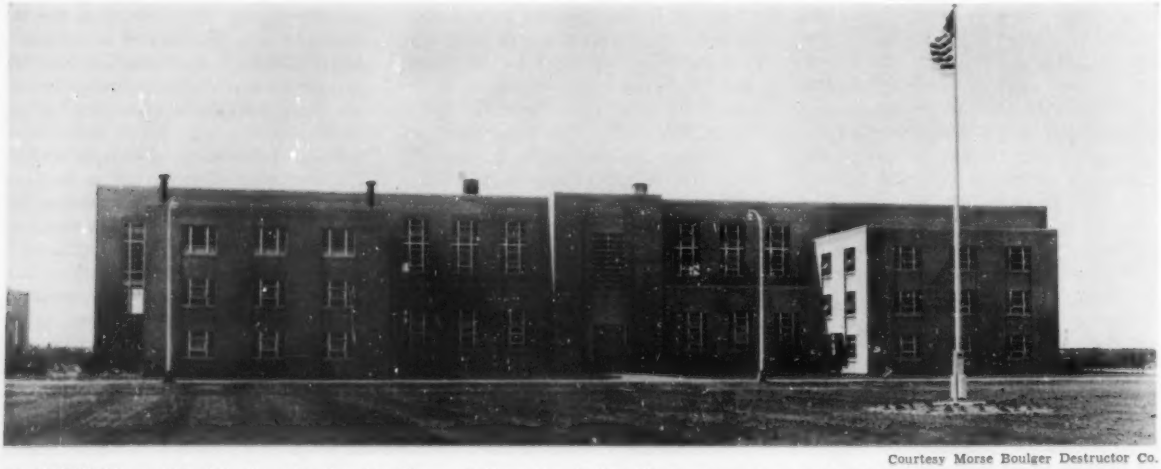
The writer agrees with the late Henry Taylor who stated: "Every engineer and every manufacturer specializing in this field has built floor-dump plants and has had an opportunity to see them in operation and that seeing should be enough."

How are floor dumps to be avoided for small plants where storage pits and crane operation may be expensive? A solution is to use a small pit and remove the refuse with a bucket, hoist and trolley controlled by push buttons or levers from the charging floor. With this design, no suspended cage or crane is needed. Two such plants are operating very efficiently in Connecticut.



Courtesy Blaw-Knox Co.

● **HERE are two 3-yard grapples which are in use at the Medill Ave. incinerator in Chicago. Pit storage of refuse provides many advantages in safety and efficiency.**



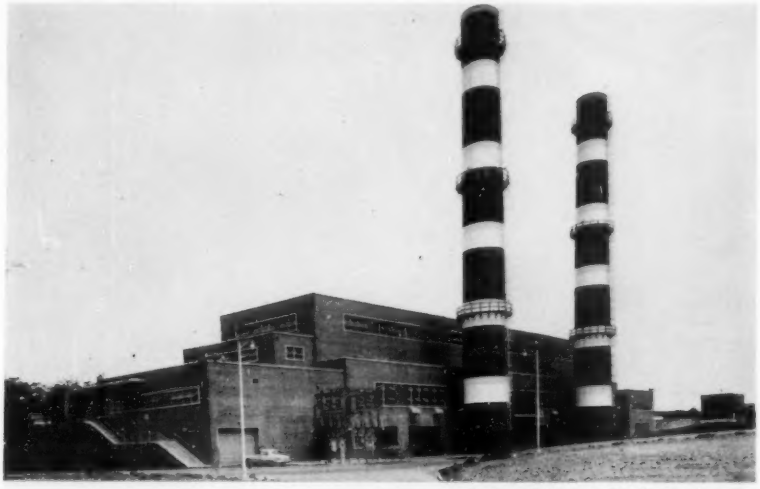
Courtesy Morse Boulger Destructor Co.

● **MODERN municipal incinerator for the Town of Hempstead, New York, presents an attractive appearance and surroundings.**

Pit storage for refuse offers many advantages. The refuse is confined. Peak truck deliveries do not overload the storage facilities so that collection schedules are not required to be staggered. Such staggering is practically impossible with private collection. Pits allow segregation of dry and wet refuse for later mixing with the crane and bucket. This results in more uniform furnace firing. Pits can be readily hosed for cleaning. This is important for proper fly, rodent and odor control. Dust and spontaneous fires in the refuse can be controlled by the use of water sprays installed along the upper rim of pits. Overtime labor is avoided with pits since sanitary storage of refuse is provided for the next day, when furnace firing can be started without waiting for truck deliveries.

Courtesy Nichols Engrg. & Research Corp.

● **REFUSE incineration plant, Philadelphia, Northeast, has a capacity of 600 tons/24 hours. Shown are enclosed ladders and "Wetscrub" fly ash control system.**



Courtesy Pittsburgh-Des Moines Steel Co.

● **THIS MODERN incinerator for Baltimore, Md., has a capacity of 800 tons in 24 hours. Note medium height chimneys with safety ladders and intermediate landings.**

needed to pass today's bulkier rubbish and to avoid spillage of refuse on the charging floor. Openings at least 4 feet square are needed. The new incinerator units at Bridgeport, Conn. have openings 4 ft. by 8 ft.

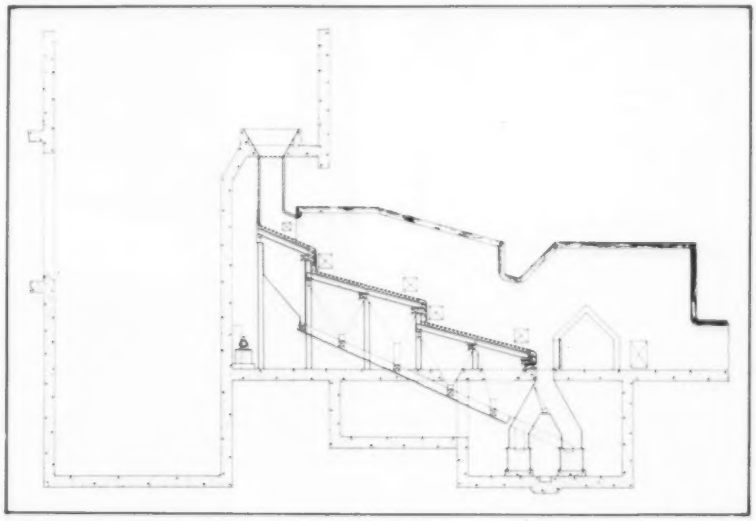
Ignition Chambers. The need for larger volumes in these chambers has already been stated. Hand-stoked chambers have practically disappeared and no one regrets their passing. Traveling or hydraulically-moved burning grates are on the increase. Hydraulic power-driven stokers in rectangular furnaces are being used in a number of new and remodeled plants in Connecticut. There is no drying hearth with these furnaces and the rows of grates are sloped 15° from the horizontal with every other grate in the rows raised hydrauli-

(*Continued on page* 184)

A few of the latest designs provide for refuse feeding by bucket, or direct from collection trucks, to a large water-cooled charging hopper from which the refuse drops continuously on to travelling grates or hydraulically-operated grates. Although relatively new, they point the way for more uniform feeding of refuse to the fire.

Chutes from elevated charging floors back to ground level are proving helpful at new plants for ready removal of rejected refuse such as wire or large cans.

Larger charging openings to the ignition chambers are being provided in new plants. These are



Courtesy Flynn & Emrich Co.

● **STOKER with electronic controls provides progressive burning with constant flow of refuse through furnace.**

TAX MAP PROJECT TAKES TO THE AIR

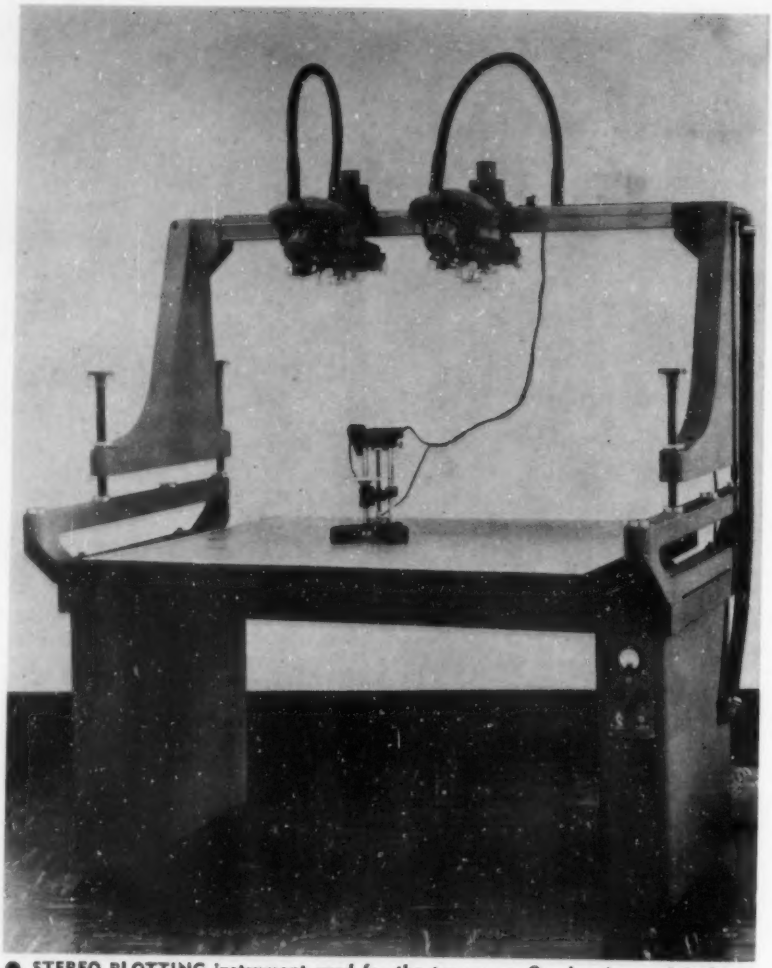
A CONTRACT for over $228,000 for preparing tax maps of Raleigh County, W. Va., has been awarded by the State of West Virginia to American Air Surveys, Inc.

This is the largest contract ever written by West Virginia for tax maps, and is the second awarded the Pittsburgh firm. The first step in the process of making tax maps has already been completed, that of taking the aerial photographs. Through the process of photogrammetry, these photographs are used to compile base maps in special 3-dimensional mapping instruments. By field contact, interviewing, and reading deed descriptions, all parcels of land in Raleigh County will be plotted on the base maps. A Bausch and Lomb Balplex stereoplotting instrument is used to compile the maps. Over-lapping aerial photos are used in this instrument. The projected image then is used to plot the base map; all roads, railroads and bodies of water appear on the map.

Chief Deputy Assessor, John Boley, will work closely with American Air Surveys to coordinate all phases of the program. The project is to be completed in twelve months.

The tax maps will be drawn to scale, setting forth dimensions, numbers and symbols for each parcel, improved or unimproved. Property record cards will then be arranged geographically according to location, dimensions, description of improvements, owner's name and address, date of acquisition, amount of tax stamps, assessed valuation, and the identifying number or symbol as shown on the tax map.

There will be a property owners' index complete with alphabetical listing of all property owners, setting forth descriptions of each parcel and cross-indexed with property record cards and tax stamps.



● **STEREO PLOTTING** instrument used for the tax maps. Overlapping aerial photos are used in this instrument and the base map is plotted from the projected images.

● **THIS IS** one of the aircraft used for the tax map projects. The pilot and the photographer are studying the flight map. The camera is shown on the ground nearby.

MAP MICROFILMING
Reduces STORAGE PROBLEM

EDWARD J. DELEHANTY,

Deputy Commissioner,

Westchester County

Dept. of Public Works,

White Plains, New York

● **MICROFILM of the blueprint on his desk is examined by E. J. Delehanty, Deputy Commissioner of the County Public Works Department. Microfilming saves space.**

BECAUSE Westchester County is located just to the North of New York City it has been for many years an area expanding rapidly with metropolitan job holders seeking suburban-type dwellings. The influx of people has necessitated a gigantic program for new roads, highways, bridges, hospitals, parks, playgrounds, and all the other facilities, construction of which come under the jurisdiction of the Department of Public Works. Going along simultaneously with new construction is an enormous maintenance and an enlargement and modernization program.

To keep pace with this job, the Department of Public Works has increased its engineering force from 35 to 103 within the past five years. As the result of this increase in employees, by the beginning of 1958 we began to be pressed for office space, and it became necessary to look for ways to give us additional room within the confines of the area allotted to us.

For some time we had been aware of the overcrowding due to a growing collection of maps and plans necessary for all our engineering work. A conservative estimate is that we had about 125,000 of these documents, some of them dating back to pre-World War I days.

Although a drawing may never be consulted again, it can never be destroyed, because each one constitutes the only engineering record of that particular job. If modernization is required, or enlargement work, or even demolition, the drawing has to be produced. They show such essentials as boundary lines and jurisdictions. From them we can often determine what needs to be done without going into the field.

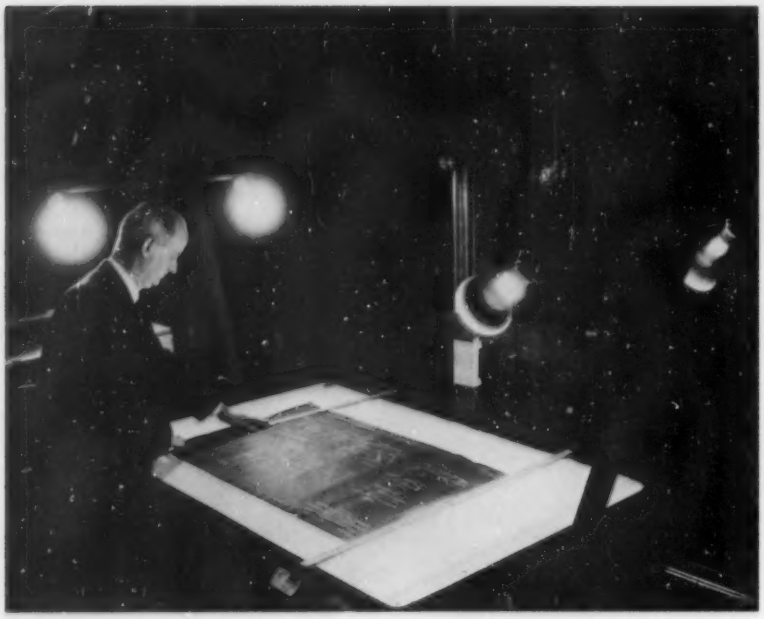
Besides the fact that there was no more space for employees, there was no room for new blueprints either. Since we employ 103 engineers and draftsmen full-time who are continually creating new drawings, we had a real problem. From 1957 to 1958, the number of contracts let by the Department jumped from 125 to 225. The budget for these contracts amounted to upwards of $5 million, and any one contract might entail as many as 100 separate drawings. About one-third of the space in our drawing room was taken up with racks filled with these essential papers.

Complicating the problem was the fact that they were dispersed in a variety of places, sometimes making it almost impossible to find them. In addition to the racks in the drafting room, there were a variety of map cases located in executive offices throughout the fifth floor. We had wooden racks of maps in rooms that might have served otherwise as working space. We had piles of drawings on top of filing cabinets in the basement of the building. Some drawings were even kept in spare storage in the jail across the street. Sometimes they were piled loosely, and thus were not indexed properly. In some cases it would take anywhere from several hours to several days to find them. The only reliable "filing system" was the memory of some of the old-time employees here, and if they retired, or were out sick, it was difficult for others to find what was needed.

The decision was made to call on professional assistance. The Business Services Department of Remington Rand, after a thorough survey, recommended microfilming all drawings not current. Among other things, this would make it possible for us to set up an indexing system that would enable us to find anything at a moment's notice.

Business Services Department personnel took over the job of filming the drawings, developing them and mounting them in 4" x 6" Kard-a-Film filing cards which are kept in vertical steel cabinets especially designed for the purpose. One of these film storage cabinets holds approximately 45,000 cards, and at the present time we have three of them.

Each card is indexed according to our own code, decipherable by consulting the index. Thus, a card may



● CAMERA can photograph drawings up to 36x47 ins. Shown is E. J. Zelt of the DPW.

● THREE film storage cabinets like this can hold about 135,000 films in all.

be numbered 5-01-S-1-0. The numeral five refers to the location; 01 to the description of the item on the card—for example, a footbridge; the letter S to the material used in construction; the numeral 1 to the drawing number; and the 0 indicates there is no revision on the plan.

A more detailed description of the plan, with cross-reference date, is kept in a Kardex cabinet. The cards are arranged alphabetically (by location) in panels of overlapping cards, with a quarter-inch visible edge showing on each one so that a momentary glance gives the code number of the microfilm card needed.

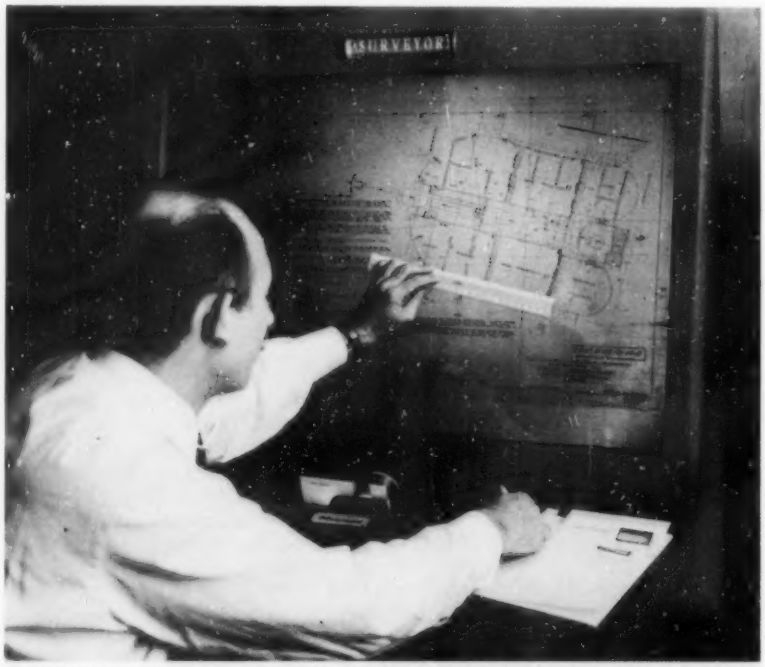
BSD personnel does our filming in the basement of the building, using a Film-a-record Planetary Camera which provides high quality filmed images of drawings up to 36 x 47 inches. Whenever a drawing is larger than this, it is filmed in sections, and the separate films numbered in sequence. We have had excellent results filming all kinds of drawings, some of them badly faded and torn.

The drawings are brought back to original or enlarged size, well lighted for easy, accurate reference, by large Surveyor Model Film-a-Record reader. We keep it in the drafting room, available to engineers and draftsmen. Any individual drawing may be printed on the reader to prepare a clear, photo-exact reproduction of the original on paper stock.

This is the only microfilm equipment we have purchased. The actual filming and indexing job was done by Business Services personnel on a flat fee basis.

As our program progresses, the benefits we are getting are significant. 1) A saving of up to 98 percent of the space formerly required for filing of original drawings; 2) Correction of the antiquated filing methods formerly in use; 3) Preservation of the record on film, guaranteeing a more permanent record, with no danger of fading; and 4) No danger of loss due to dispersal of records.

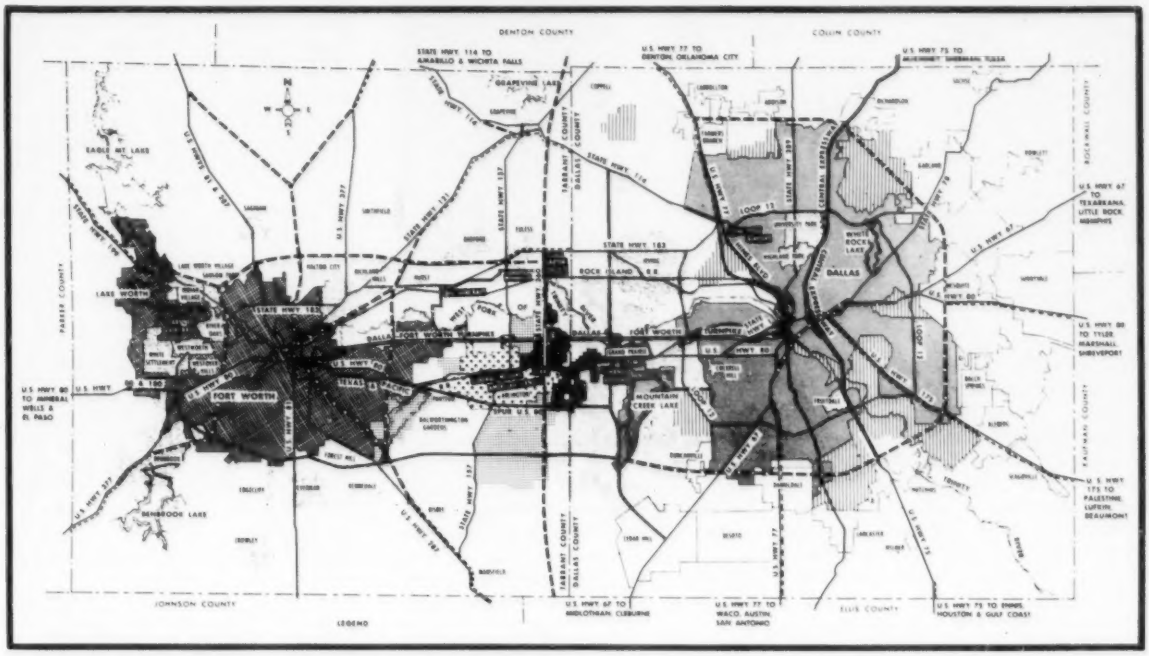
As the Public Works program grows to provide the facilities a growing population must have, we are now better equipped to handle the load. With additional office space and quick, accurate references at hand, we feel we are doing a better job than ever before.



● DRAWING can be blown up to larger than its original size when needed for study.

PLANNING

A TWO-CITY INDUSTRIAL SITE



● **THIS MAP shows the general layout of the two-city industrial site. Dallas as shown at the right and Fort Worth at the left.**

R. L. POWELL,

Powell and Powell,
Consulting Engineers,
Dallas, Texas

THE GREAT Southwest Industrial District — which, as GSID, is becoming a by-word in the Southwest — lies in the heart of an historical section of Texas, midway between Dallas and Fort Worth. Here are headstones of the Watson Cemetery dating back to 1857, a long time ago in these parts, considering that some of those laid to rest here were victims of Indian raids which occurred for several years after that date. However, the historical significance of the area would appear to be just beginning to unfold, as the Southwest undergoes the transition from an agricultural to a balanced economy. With this transition, industry and distribution facilities are seeking well-located sites to meet expanding demands.

GSID, ultimately a development of over 5,000 acres, is ideally situated to supply these desirable sites with its first increment of improvements occupying 2,600 acres. The area is nearly bisected by the Dallas-Fort Worth Turnpike in an East-West direction, and by State Highway 360 in a North-South direction; U. S. Highway 80 bounds the District on the south. These arteries provide quick access for motor transport to every section of the country. The Turnpike is a heavy-duty six-lane limited access highway, leading to the central business district of each terminal city. State Highway 360 is an important connecting link with the projected Interstate Highway System and is being built in stages to conform to design requirements of that System. The interchange and access ramps to these important roadways are located in the heart of GSID.

The area is served by two major rail systems, the Rock Island, whose main line lies about six miles to the north, and the Texas and Pacific, which runs parallel to U. S. Highway 80, along the south boundary of the district. Industries within the district are served by the Great Southwest Railroad, a terminal rail facility created to provide switching service in the district and interchange between the carriers.

Air transportation facilities are convenient to GSID. Dallas' Love Field is within 30 minutes travel time, and Fort Worth's Carter Field, with the completion of Highway 360, is within ten minutes travel time.

In addition to the advantages of location and accessibility, the district possesses the very important virtue of being new in the sense that it is carved out of practically virgin territory. Thus, the district's development has been governed only by its physical boundaries, its topography, its relation to the transportation facilities already mentioned and by the foresight and vision of the developers. The development company, Great Southwest Corporation, was formed after the possibilities of the site became apparent to William Zeckendorf of Webb & Knapp and Angus G. Wynne, Jr., of Dallas. These men,

● **AERIAL VIEW showing GSID under construction. At right center is intersection of Fort Worth-Dallas Turnpike with SH 360. Bridges and buildings are being built.**

along with the Rockefeller interests of New York, Toddie Lee Wynne of Dallas, and Fort Worth investors, including Amon Carter, Jr., and Robert Anderson, put up the capital to acquire the land and initiate development.

GSC retained Associated Architects & Planners to execute the Master Site Plan and develop Planning Standards. This has resulted in a carefully organized group of industrial communities, each providing within itself a "community center" of restaurant, motel, shops and service facilities for the factories and warehouses within each community. The first two of these communities — Industrial Community Number 1 and Industrial Community Number 2—are now in process of development. The planning standards provide for all construction to be of masonry or of an approved equivalent material and specify a maximum building-to-land ratio to assure an attractive and spacious layout. They also cover traffic circulation, off-street parking facilities, landscape treatment and land uses.

While GSID is in an undeveloped area, it is not a rural development remote from centers of business. The central business districts of Dallas and Fort Worth are about fifteen miles to the east and to the west, respectively, but each city has expanded to within twelve miles of each other. Between them lie the City of Grand Prairie to the east, contiguous with Dallas, and the City of Arlington to the west, contiguous to Fort Worth. Arlington and Grand Prairie abut each other, with the common corporate limit line running almost through the middle of GSID. These two cities, which were until a few years ago small residential towns, are now business and industrial centers with attendant residential and commercial expansion. Each has been faced with the problem of extending water and sanitary sewers rapidly enough to serve the increasing population. Fortunately, at the time GSC came into being, each city had construction or planning underway for extending these municipal services to the area to be occupied by GSID. Each city also had in effect zoning ordinances, platting regulations and design standards for utilities and paving. Since all of GSID lies in either Arlington or Grand Prairie, all improvements are correlated with existing or projected facilities to provide adequate extensions of municipal services into the new industrial development.

Utility Design

Water distribution within GSID will be handled by a network linking together a 24-in. supply main recently completed by the City of Grand Prairie to the edge of the project and a 16-in. loop in process of construction by the City of Arlington. This network is designed to fulfill fire-fighting requirements as well as normal demands for this type of development. Stage construction is now being used, providing sufficient capacity as required. Normally, the system will be divided, each city supplying and billing users in their respective limits, but provision has been made for inter-connection to meet emergency conditions. Ultimately, it is planned to provide metering arrangements to permit the two systems to function jointly. Of immediate benefit to GSID is the current construction of a one-million gallon elevated tank in Industrial Community Number 2, by the City of Arlington.

Water demand was estimated from use figures obtained from two nearby aircraft assembly plants. It was assumed that GSID would have no greater density of population than these plants and would generally have less. This provides for very little water use in plant processes, confining demand primarily to domestic type uses and fire-protection. The ultimate design is based upon an estimated population of 40 persons per acre with average use of 75 gallons per capita per day and peak use of 110 gallons per capita per day. For the area under consideration, this amounts to 8 mgd annual average consumption and 12 mgd peak 24-hour consumption.

Fire protection requirements are based upon the recommendation of the Fire Prevention and Engineering Bureau of Texas, that there be provided a minimum fire flow of 4000 gpm for a period of ten hours, in addition to normal usage, amounting to 27 mgd. These figures do not allow for all of the GSC property, some of which is remote from existing mains.

The initial overall layout calls for a 24-in. backbone connecting the Arlington system with the Grand Prairie system, running generally through the center of the project. This main would supply smaller-diameter mains looping blocks as they are developed. However, the initial construction has consisted of 12-in. mains, and this may result in a network of 12-in. or 16-in. mains in lieu of the proposed 24-in. backbone. No zoning of water users has been contemplated, mainly because GSID has been developed so far primarily as a distribution and light manufacturing center. The problem of big water users will have to be treated on an individual basis whenever the need arises.

Likewise, the pattern of development of the project will be governed by factors other than engineering, and improvements will have to be designed accordingly. Admittedly, this is not conducive to the most economical and efficient design for a water system, but it can be seen that it is better business for the developer to pay a little more to provide necessary facilities to installations whose locations are fixed than to install complete facilities in arbitrary patterns and then try to make prospects with peculiar problems fit into the pattern. This is a planned industrial district in the

sense that an overall plan has been developed and is, in general, adhered to, and that planning standards have been adopted to govern all construction in the district. However, the developers have carefully maintained flexibility in development, even at the risk of extra expense in improvement cost.

The same factors governing planning for water distribution apply to sewerage. For design purposes, we have assumed sewage flow to be one-half of estimated water use.

The sanitary sewerage system for GSID is developed around Arlington's 30-in. outfall sewer which crosses the project as it follows Johnson Creek to the City's new disposal plant. This plant now has a capacity of 5 mgd and is designed for expansion to double that capacity by building additional filters. Provision has been made for ultimate capacity of 20 mgd. Arlington's long-range plan calls for construction of a parallel outfall line when conditions require additional capacity. All of the project can be served by gravity sewers except for the southeast portion of Industrial Community Number 2, which lies in a valley which drains northeast into an undeveloped area in Grand Prairie. This tract is now sewered into a lift station until such time as development within Grand Prairie justifies extension of a gravity system to GSID. Gravity lines flow northward along valleys which drain to Johnson Creek.

Drainage

Johnson Creek, which traverses GSID from its southwest corner in a northeasterly direction to its east boundary, provides the main drainage feature for the district. This creek heads some five miles to the south and drains a good portion of Arlington before reaching GSID. It continues through GSID and beyond to its confluence with the Trinity River, about two miles to the east. Normally a small creek during the prevailing dry weather, Johnson Creek becomes a raging torrent following the occasional storms which occur in the area. The planners have shown due respect and designated the flood plain of this creek to be a green area. Tributary to Johnson Creek are a series of draws draining to the north through Industrial Community No. 1 and through all of Industrial Community Number 2 except the southeast corner. Storm drainage is collected into these natural channels where it is carried northward in streets and storm sewers. This system of parallel valleys has permitted use of small diameter pipe with the exception of a 54-in. storm sewer in the major draw through the west end of Industrial Community Number 1. The independent drainage course flowing northeasterly through the southeast portion of Industrial Community Number 2 is of considerable importance and will require relatively large diameter storm sewers in that portion to be enclosed. The lower end of this draw is also designated a green area which will feature two existing small lakes.

● **PLANNERS' view, looking northeast, shows the area as it is expected to be when Industrial Communities 1 and 2 have been developed and construction completed.**

The street system in GSID is designed primarily for access and circulation within the district, but it is correlated with projected thoroughfares in Arlington and Grand Prairie. Street widths have been established by studies and recommendations prepared by Lloyd Braff, formerly Traffic Engineer for the Metropolitan District of Los Angeles. Pavement design provides 7-in. hot-mix asphaltic concrete on a 6-in. treated sand-clay base, with 30-in. concrete curb and gutter.

Street pavement was designed with heavy truck traffic in mind and street sections provide for a heavy volume of traffic. Initial contracts provided for paving the outside lanes, each 22.5 feet wide, leaving a median to be paved later as traffic demands.

The Great Southwest Railroad crosses the Fort Worth-Dallas Turnpike and State Highway 360 on bridges 230 feet and 412 feet long, respectively. These are prestressed concrete structures designed for Coopers E-50 loading with 30 percent impact. Maximum span length is 68 feet, each span consisting of six beams of 46-inch depth. These structures are topped with concrete decks carrying normal ballast section.

The Johnson Creek Valley and all of the tributary valleys in which GSID lies have fairly rapid gradients, up to about 5 percent. These grades created problems with railroad planning, where it was desired to maintain a maximum grade of 1.5 percent. This requirement called for extensive site grading involving movement of over three million cubic yards of dirt.

Plan of Operation

Great Southwest Corporation will either sell or lease sites to suitable industries. The corporation will also erect the buildings, either for sale or for lease. No industries which create noxious odors or fumes, or which are characterized by unsightly surroundings or objectionable noises are admitted to the district. Buildings occupy no more than 40 percent of each site, and occupants agree to provide and maintain landscaping.

Arlington and Grand Prairie provide normal housekeeping services such as garbage collection and street cleaning. Unusual industrial wastes are disposed of by contractors.

Texas Electric Service Company has worked out the street lighting plan with the developers. This consists of luminaire-type fixtures in the median strips of the streets. Other illumination will be the responsibility of the industries.

Powell & Powell, Consulting Engineers, Dallas, have prepared the plans for and supervised construction of improvements in GSID, including rail construction.

A CHECK LIST for Water Treatment Plant Design

This check list is extracted from a report by David P. Green, submitted to the Faculty of the University of North Carolina, Department of Sanitary Engineering, in partial fulfillment of the requirements for the degree of Master of Science in Sanitary Engineering.

A WATER treatment plant design should take into consideration the ease of operation and maintenance of the facilities provided. The use of a check list is considered to be a systematic approach to this problem, though it cannot supplant experience nor discussion between the designer and operating personnel for specific installations. This check list will not meet the full requirements of every designer. It is intended as a basic approach, and the user is urged to expand it or modify it as his experience or problems require. While most of the check list is self-explanatory, some of the more salient points are discussed in the following.

General—A desirable plant site takes advantage of topography and is accessible by an all-weather access road. Rail sidings are desirable in the larger plants where bulk chemicals are used. The plant should be oriented to utilize fully the site both for present construction and for future expansion.

Exterior lighting should be provided for architectural effect, operational convenience, safety and protection against vandalism. Walkways around all open tanks should be provided with guard rails, particularly if the plant is open to visits by the public.

Piping should be laid out with short runs and short suction lines. The generous use of mechanical couplings enables repairs on valves, automatic equipment, etc., in a minimum time. Pipes should be installed where access for maintenance and repair can be provided. If the pipe is under pressure, harnesses and thrust blocks should be supplied. Sufficient clearance for easy installation must be left between the wall and the joint. Additional clearance sufficient to pass operating personnel, pipe and fittings should be provided in large galleries and conduits.

Bypasses are required around units not duplicated and those not in use throughout the year. Bypassing of chemical feeding, sedimentation, and filtration should not be possible.

Service Buildings—The selection of materials with pleasing appearance and low maintenance requirements is good preventive maintenance and often leads to operational efficiency.

Space must be provided for offices, control rooms, laboratories, filter galleries, pump rooms and chemical feed and storage. Further service areas must be provided for boiler rooms, pipe galleries, electrical control centers, tool rooms, shops, record storage and spare parts storage. Personnel will require locker rooms, lavatories, showers, toilets, and lunch rooms. Additional toilet facilities should be provided for administrative personnel adjacent to their work areas and for the public.

Well located hose bibs and floor drains are necessary for cleaning and other maintenance operations. Electrical outlets should be provided throughout the building to serve portable power tools and to supply additional connections for illumination during repairs. Maintenance operations will be further facilitated if hoists are available for lifting heavy equipment.

Heating and air-conditioning systems are recommended for at least parts of the plant. General and local exhaust ventilation must be considered in relation to specific requirements of the various sections of the service building.

Laboratory space should include specific areas in the smaller plants or specific rooms in the larger plants, devoted to physical and chemical analyses, bacteriological analysis and storage. The quantity, type and size of the various laboratory furniture and equipment will depend to a great extent on the size of the plant and the technical competence of the laboratory personnel. Lists of specific equipment can be obtained from state health departments and manufacturers.

Gas, water, vacuum, electricity and air must be provided for the laboratory benches. It may be advisable to provide 220-volt service to certain of the laboratory areas for furnaces and ovens.

Bulk transfer of chemicals directly to storage may include pneumatic systems or bucket or screw conveyors, which should be completely enclosed to prevent dust problems. The equipment must be readily accessible for maintenance and repair.

Where elevators are used, a specific elevator should be restricted to chemical handling and equipment use and not combined with passenger use.

A separate building is preferable for chlorination equipment. Otherwise the chlorine room should be isolated from the rest of the plant and have access only from the outside. Fixed glass inspection panels are necessary. The doors should open out and be equipped with fixed louvers. A forced exhaust ventilation system with the fan control outside the room is required. Care must be given to the location of the exhaust point to prevent reintroduction of the gas into the building.

Space for flush surface scales should be provided, and scale pits should be drained. Adequate support to protect the cylinders from accidental damage is required. Hoists are indicated in the larger installations where either a number of smaller cylinders or one-ton cylinders are used.

A separate room is desirable for the storage of cylinders. Like the chlorination room it should be equipped with scales and hoists and a forced ventilation system. The same location, fire and access control requirements apply.

Fluorides are generally fed utilizing solid materials. It is necessary to provide an adequate dust control system to prevent possible inhalation of toxic substances by operating personnel.

Aeration—Since both the efficiency of operation and aesthetic effect of spray aeration are dependent upon the evenness of height to which the sprays reach, the piping system should be designed so that the head loss over the length of the

distributor is small compared to the head loss in the nozzle. The individual laterals should be valved to allow the capacity of the unit to be varied with seasonal changes in demand. A bypass should be provided both to allow maintenance of the unit and to permit seasonal operation.

Filtration—Wash water for filters may be supplied by either a high capacity pump or from a wash water tank and should be based on summer conditions. If a tank is used, the elevation of the tank bottom should be sufficiently high to overcome the head losses involved in transmission to the filter and the backwashing operation. If a pump is used to provide the wash water, a schedule should be provided for washing which will avoid, if possible, peak demand electric rates.

A surface wash is considered a necessity in a modern water treatment plant. A separate booster pump and valving system should be provided for surface wash water.

Plant Storage and Pumping—In general, each pump should have its own suction line which should be kept as short as possible. Gate valves should be used on both suction and discharge lines and a check valve on the discharge line. The pump should be protected by utilization of delayed closing valves or allowance for backspin and each pump should be furnished with a disconnect switch.

Adequate working space around the machinery should exist and extra space allowed if there is any chance that a larger pump may be installed at some future date. An uncomplicated piping system is desirable, with concealed pipe placed in chases.

WATER TREATMENT PLANT CHECK LIST

GENERAL

POPULATION SERVED: Present....., design.....,
Water use: Present, average day ....., maximum day ....., design range .....

SURFACE SOURCE: Stream ....., flow, average cfs ....., max....., min.....; depth at intake, min....., max.....; maximum permissible draft..... Reservoir....., area.....,
capacity.....; average yield....., max ....., min.....; high water level.....
lwl..... Existing water rights....., additional available..... Watershed sanitation control; Ordinance....., enforced.....

WELL SOURCE: Number of wells ....., depth ....., diameter....., distance apart.....,
soil formation....., static level....., draw down....., screen length..... Yield, average ....., max.....,min..... Power, normal ....., standby..... Pumps, type.....,
number....., total capacity..... Sanitary protection of wells.....

RAW WATER QUALITY: Total solids.....,
turbidity....., hardness....., chlorides ....., alkalinity....., pH....., MPN range ....., iron and manganese....., fluorides ....., taste and odor....., algae varieties and concentrations.....

TREATMENT PLANT LAYOUT: Site: Distance from city ....., paved access roads....., rail siding ....., protection against flooding....., area required for present use....., available for expansion..... Planning of grounds: Landscaping ....., drainage....., parking.....,
driveways....., walks..... Exterior lighting: Walkways....., roadways....., outside valves....., motor controls....., open tanks ....., clear water reservoir.....

CHANNELS AND PIPING: Adequacy for ultimate plant capacity....., arrangement for expansion ....., short suction lines....., accessibility for repair....., accessibility of valves.....,
clearance between flanges and walls....., hydraulic thrust prevention....., pressure reducing valves on plant service....., avoidance of cross connections....., bypasses only on duplicated units ....., exposed piping color coded.....,
velocity in waste channels.....

SERVICE BUILDINGS

SPACE PROVIDED FOR: Offices .....,
laboratory....., control room....., chemical storage....., chemical feed....., locker room ....., toilets....., wash room....., record room and library....., lunch room.....,
tool storage....., shop....., boiler room ....., janitor storage.....

ARCHITECTURAL: Illumination: Window area.....,
fixtures..... Heating....., ventilation ....., air conditioning....., electrical outlets....., water....., hot water.....,
hose bibs....., floor drains....., sewer and sewage disposal..... Building exterior.....,
interior....., corridor and door sized to pass equipment....., equipment hoist.....,
elevators....., stair widths.....

WATER TREATMENT PLANT CHECK LIST

SERVICE BUILDINGS (Cont.)

LABORATORY: Utilities: Hot and cold water....., gas....., air....., vacuum....., electricity....., Sampling lines....., Fire protection ....., safety shower....., exhaust hood and fans....., first aid equipment..... Furniture: Chemical-resistant counters.....,acid-proof sinks....., desks....., reagent storage ....., equipment and supply storage....., refrigerator..... Major analytical equipment: Incubator....., oven....., furnace....., microscope....., analytical balance....., still ....., pH meter....., turbidimeter....., colorimeter....., stirring device....., steam bath....., hot plate....., glassware....., reagents.....

CONTROL CENTER: Recording instruments: Flow....., pressure....., level..... pH....., chlorine residual.....,chemical feed....., power ..... Indicating instruments for: Pumps....., valves....., chemical feeders..... Manual override for automatic controls..... Alarms..... Switchgear.....

CHEMICAL STORAGE AND HANDLING: Monthly volume of chemicals....., bag storage volume ....., bin volume....., mechanical and pneumatic conveyors....., hand or power trucks....., unloading platform....., dust control..... Chlorine storage room: Monorail and hoist....., separate access....., proximity to feeders..... Chemical feeders: Alum or iron....., lime....., fluoride....., carbon....., chlorine....., soda ash..... Types of feeders..... Duplicate equipment..... Corrosion resistant piping..... Chlorinator room: Isolated structure....., heating ....., exhaust facilities....., personnel safety equipment.....,leak detection....., louvers in door....., door opening outward....., inside fixed window....., light switch near door ..... General: Water and electric outlets....., hose bibs....., floor drains....., lighting....., heating....., ventilation.....

INTAKES

INTAKES: How many....., size....., capacity ....., head loss....., invert elevation of pipe out....., distance intake from shore....., elevation of openings....., ice protection..... Type of screen used....., material....., mesh or opening size....., power requirements....., area of openings....., gals/sf/min through screen..... Are screens removable?....., are there duplicates? ....., method of cleaning.....

RAW WATER TRANSMISSION

SUPPLY LINE: Number....., size....., material ....., delivery, mgd..... Pipe interior: C= ..... Gravity flow....., by pumping....., pressure at plant....., head pumped against....., velocity in line for design flow....., corrosion protection....., interconnections between lines....., air relief valves....., drains at low points....., isolation of sections for repairs provided by..... valves at.....intervals, access to right-of-way....., metering.....

PUMPING STATIONS: Location....., number of pumps....., capacity of pumps....., size of suction lines....., size of discharge lines....., types of pumps....., power requirements....., standby power....., flood protection..... Water hammer protection....., access roads....., office in building....., shop facilities....., heating ....., lighting....., toilets.....

AERATION

STRUCTURE AND EQUIPMENT: Purpose of aeration ..... Point of aeration..... Spray aerator: Height of jet....., angle of jet....., head loss in nozzles....., head loss in distributor, total head loss ..... Cascade aerator: Total height....., head loss..... Coke tray aerator: No. of trays....., tray area....., flow rate, gpm per sq. ft..... General: Basin area....., depth....., freeboard ....., screening....., louvered....., height of cut off wall....., provision for bypassing....., provision for draining....., invert elevation of effluent channel.....

COAGULATION

CHEMICALS to be used..... Design dosages.....

RAPID MIX: Tanks: Number....., length....., width....., depth....., retention time.....,

head loss allowed....., freeboard....., provision for draining....., for bypassing..... Mixer: type....., RPM....., HP.....

FLOCCULATION: Tanks: Number....., length width....., depth....., retention....., freeboard....., velocity gradient ....., head loss allowed..... Type of mixer..... peripheral speed..... HP..... Velocity of flow between units: Rapid mix to flocculation....., flocculation to sedimentation....., weir or baffle adjustment possible....., can tanks be drained?..... provision for bypassing....., are walkways and guard rails provided?....., ice protection.....

SEDIMENTATION

BASINS: Number....., length....., width....., depth....., diameter....., retention time....., overflow rate....., flow line elevation....., permissible variation in flow line....., sludge removal ....., effluent discharge.....types of weirs ....., weir overflow rate....., ice protection tank freeboard....., can tanks be drained?....., where to? ....., are walkways and guard rails provided?.....

EFFLUENT CHANNEL: Width....., depth....., freeboard....., maximum velocity....., head loss....., sluice gates.....

FILTERS

FILTERS: Unit size....., number of units.....

FILTER MEDIA: Fine media material....., effective size....., uniformity coefficient....., depth ..... Coarse media: Material....., size range ..... Underdrainage type..... Rate of filtration..... Rate of backwash....., wash water trough spacing....., trough size....., shape ....., slope....., lip elevation above filter surface....., design rise of fine media....., freeboard....., design head loss....., walkways and guard rails....., protection against freezing....., provision for placing and removing media.....

WASH WATER: Pump....., capacity....., where from?..... Tank: Capacity....., minimum elevation above filter....., size of outlet pipe ....., method of filling tank....., capacity for at least two filters?....., waste overflow to where? ....., cross-connection possible?..... Surface wash provided....., rpm....., nozzle velocity ....

FILTER CONTROLS: Rate of flow control type....., location..... Indicating and Recording Instrumentation: Control tables....., rate of flow....., rate of rise....., percent media expansion....., loss of head.....

PIPE GALLERY

DIMENSIONS: Height....., width....., lighting....., ventilation....., explosion proof wiring ....., floor drain....., sump pump....., discharges to....., adequate clearance under pipes ....., flanged pipe used....., couplings at intervals....., sufficient space for servicing....., access to valves..... Piping color coded?.....

CHLORINATION

CHLORINATORS: Number....., type....., capacity....., point of chlorine application....., design dosage....., contact period provided....., is chlorination automatically controlled?....., on what basis?....., gas withdrawal rate....., Scales .....

SOFTENING

HARDNESS to be reduced from..... to.....

METHOD: Cation Exchange: No. of units....., flow through rate....., size....., media....., salt storage....., brine tank....., controls..... waste disposal..... Lime Soda: Chemicals used ....., anticipated design dosage..... Recarbonation: quantity needed....., source of CO_2 ....., scrubber....., compressor....., basin size....., detention time.....

PLANT STORAGE AND PUMPING

CLEAR WELL: Location....., capacity....., no common wall with other plant units....., high water elevation....., low water elevation....., head differential permits maximum filter rate?.....

HIGH SERVICE PUMPS: Number....., capacity ....., power requirement....., space for additions....., standby power....., separate intakes for each pump....., elbows on intakes....., gate valves on intakes....., gate valves on discharge ....., check valves on discharge....., Pipe size out of plant....., capacity, mgd....., water hammer provisions.....

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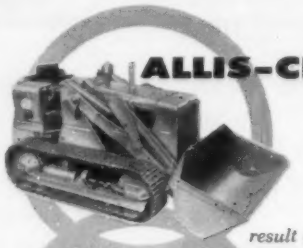
because the specialized experience of two pioneer companies in front-end loaders is now combined . . .



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—pioneer of the world's first successful hydraulically-controlled crawler-mounted tractor shovel.

result of 14 years' leadership

TRACTOMOTIVE
—one of the first to develop heavy-duty rubber-tired loaders.

result of 11 years' leadership

Now Tractomotive Corporation has become part of Allis-Chalmers . . . and that means we'll be able to serve you better than ever. One very important reason is that the specialized experience of each organization in its field cannot be surpassed.

Allis-Chalmers pioneered its history-making HD-5G in 1945 . . . has led the field in crawler shovel design and performance ever since . . . now offers the most complete line of such equipment in the industry, with bucket sizes from 1½ to 7¼ cu yd.

The Tractomotive team has been building heavy-duty wheel loaders since 1948 . . . has consistently pioneered developments of great value to users, including torque converter drive and single-lever shifting control.

Through the combined facilities of these two pioneers, we offer you industry's most complete line of front-end loaders, on rubber or tracks . . . with these added basic advantages to back it up!

- another modern plant joins Allis-Chalmers' extensive facilities for manufacturing construction machinery
- a company-wide record of engineering leadership in all types of heavy-duty equipment
- widespread research activity that insures continuing progress
- original factory parts and blue-chip parts control
- increased man power in sales and service

See 'em at work—your Allis-Chalmers dealer will be glad to demonstrate the machine of your choice—wheel or track-mounted, whichever meets your job needs best. Just give him a call. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.

YOU'RE AHEAD with a TRACTOLOADER

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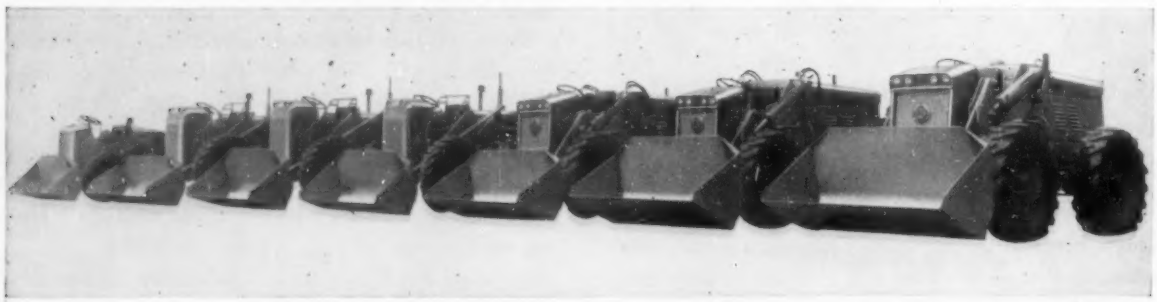
Seven models—34 to 130 hp—up to 9,000-lb carry capacity. Torque converter drive in every model.



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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Scenic Seattle Host To APWA's 65th Anniversary Meeting

Seattle, Wash.—The 65th Annual Public Works Congress and Equipment Show in Seattle, September 20-23, will feature the largest display of public works equipment ever assembled in the great northwest as well as panel discussions, technical forums and a workshop on administrative problems which makes it a fact finding opportunity that public works officials can't afford to miss.

The APWA meetings will be held at the Civic Auditorium, Seattle. On Sunday, September 20, there will be registration and review of exhibits, followed by a 1½-hour tour of scenic Seattle. Later there will be a drawing of attendance prizes, followed by a salmon barbecue. The Congress will be opened Monday with Roy W. Morse, Chairman, Board of Public Works and City Engineer, Seattle, and General Chairman, 1959 Public Works Congress & Equipment Show, presiding. Following the invocation and the keynote address by William D. Hurst, President of the APWA, and an address of welcome by Hon. Gordon Clinton, Mayor, Seattle, the annual business meeting will be held.

A Panel discussion: "How Communities Benefit From Chapter Activities" will be moderated by Jean L. Vincenz, Vice President, APWA. Participants will be Kenneth Cullen, City Engineer, Dubuque, Iowa; Myron Calkins, City Engineer, Tacoma, Wash.; John Lambie, County Engineer, Los Angeles County, Calif.; and Robert L. Anderson, Superintendent of Public Works, Winnetka, Ill.

At the afternoon session, "Public Works in London, England" will be presented by Joseph Rawlinson, C.B.E., Chief Engineer, London County Council, London, England and "Modern Applications of Soil Engineering" by Will D. Shannon, President, Shannon and Wilson, Soil Engineers, Seattle, Wash. There will be a panel discussion on "Municipal-Contractor-Engineer Relationships" with Glenn P. Clasen, President of City Council, New Orleans, La., as moderator. Discussants will be: Municipal Official, Gordon Burt, City Engineer, Portland, Ore.; Contractor, John A. Thompson, J. A. Thompson & Son Contractors, Los Angeles, Calif.; Consulting Engineer, Earl J. Thomson, Burns & McDonnell Engineering Co., Kansas City, Mo.

On Tuesday forenoon there will be four concurrent forums:

Solid Wastes—Presiding: Carl Smith, Director, Department of Health, Cedar Rapids, Iowa. Topics and speakers: "Reclamation and Salvage Operations"—William A. Xanten, Superintendent, Division of Sanitation, Washington, D. C.; "Physical and Chemical Analysis of Refuse"—Don Bloodgood, Professor of Sanitary Engineering, Purdue University, Lafayette, Indiana; "Sanitary Landfill Costs and Equipment"—Wilson J. Myers, Director of Public Service, Canton, Ohio; "Factors to Consider in Purchasing Refuse Collection Equipment"—

● SEATTLE'S Civic Auditorium will be the site to the 65th meeting of the APWA.

OFFICERS: Wm. D. Hurst, Winnipeg, Manitoba, Canada, *President;* Jean L. Vincenz, San Diego, Calif., *Vice President.* REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. *Immediate Past President,* Sol Ellenson, Newport News, Va. Robert D. Bugher, *Executive Director.*

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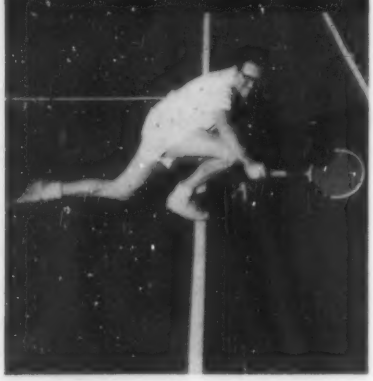
RUBBERIZED TENNIS COURT



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Saf-Pla photographs taken at Agassiz Circle, Delaware Park, Buffalo, N. Y.

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Bul et n No. 17

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Theodore C. Eppig, Deputy Commissioner, Bureau of Sanitation & Equipment Services, Chicago, Ill.

Streets and Highways—Presiding: H. H. Hester, Superintendent of Streets, Fort Worth, Tex. Topics and speakers: "Street Cleaning Equipment and Operating Procedures"—Michael J. Carozza, Director of Public Works, Fresno, Calif.; "Programming Street Maintenance Works"—Walter Tacke, Deputy Commissioner, Department of Public Works, Milwaukee, Wisc.; "Maintenance of Railroad-Highway Grade Crossings"—J. M. Trissal, Vice President and Chief Engineer, Illinois Central Railroad, Chicago, Ill.; "Construction and Maintenance of Bituminous Pavements"—Gordon Bodien, City Engineer, Minneapolis, Minn.

Water and Sewage—Presiding: Robert B. Smith, City Engineer, Anchorage, Alaska. Topics and speakers: "Catch Basin Design"—W. W. Baker, City Engineer, Oklahoma City, Okla.; "Separation of Storm Water and Sewage"—Robert G. Anderson, Construction Engineer, Dept. of Public Works, Tacoma, Wash.; "Sewer Joints and Materials"—Charles A. Johnson, City Engineer, Midland, Mich.; "Curved Sewers"—Harvey F. Ludwig, Consulting Engineer, Engineering-Science, Inc., Pasadena, Calif.

Buildings and Equipment—Presiding: Reed McKinley, Director, Department of Public Works, Kansas City, Mo. Topics and discussers: "Procurement of Automotive Equipment"—Ernest Fort, Director of Public Works, Miami, Florida; "Equipment Rental Operations"—Chester L. Waggener, City Administrator, Moses Lake, Wash.; "Uniform Reporting of Building Maintenance Costs"—William R. Blakely, Director, Bureau of Public Buildings, Department of Public Works, Los Angeles, Calif.; "Preventive Maintenance of Installations in Buildings"—Herman L. Danforth, Director of Public Works, Tucson, Ariz.

Afternoon sessions will include four forums:

Solid Wastes—Presiding: Manon P. Phillips, Commissioner of Public Works, Augusta, Ga. Topics and Collection Routes"—G. B. Robertson, Superintendent, Department of Sanitation, Albuquerque, N. Mex.; "When to Build an Incinerator"—William S. Foster, Editor, The American City, New York, N.Y.; "Use of Completed Sanitary Landfill Sites"—Casimir Rogus, Director of Engineering, Department of Sanitation, New York, N. Y.; "Management of Refuse Disposal Facilities"—Abraham Michaels, Chief Sanitation Engineer, Philadelphia, Pa.

Streets and Highways—Presiding: James L. Morris, City Engineer, Boise, Idaho. Topics and speakers: "Maintenance of Landscaped Right-of-Way"—Ray Burgess, Director of Public Works, Baton Rouge, La.; "Case Studies of Traffic Control Measures"—Norman Kennedy, Assistant Director, Institute of Transportation and Traffic Engineering, University of California, Richmond, Calif.; "Administration of Snow and Ice Removal Operations"—Leonard H. Caro, Director of Streets and Sewers, Peoria, Ill.; "Construction and Maintenance of Concrete Pavements"—W. M. Bryant, City Engineer, Jacksonville, Fla.

Water and Sewage—Presiding: Frederick W. Crane, General Manager, Buffalo Sewer Authority, Buffalo, N. Y. Topics and speakers: "Ontario's Multi-City Water Distribution System"—Dr. A. E. Berry, General Manager, Water Resources Commission, Toronto, Canada; "Industrial Waste Rates and Regulations"—J. F. Laboon, Executive Director and Chief Engineer, Allegheny Sanitary Authority, Pittsburgh, Pa.; "Rainfall - Runoff Studies"—G. S. Seabrook, City Engineer, Puyallup, Wash.; "Automation of Water and Sewage Works"—Richard R. Kennedy, Partner, Clyde C. Kennedy Consulting Engineers, San Francisco, Calif.

Buildings & Equipment—Presiding: James T. Waggoner, Commissioner of Public Improvements, Birmingham, Ala. Topics and speakers: "Contracts and Specifications for Remodeling Buildings"—Fred B. McCoy, Superintendent of Buildings, Seattle, Wash.; "Mobile Communication Developments"—Joseph V. Guido, Motorola Communications and Electronics, Inc., Seattle, Wash.; "Determination of Equipment Storage Requirements"—Herbert A. Olson, Management Consultant, Public Administration Service, Chicago, Ill.; "Systematic Maintenance of Motor Vehicles"—Richard F. McBean, Superintendent of Automotive Equipment, Honolulu, Hawaii.

On Wednesday there will be a workshop on administrative problems. Presiding will be John Craig Oliver, Commissioner, Board of Administration, Vancouver, B. C. Topics and speakers:—"Planning"—Reuben Owens, Director of Public Works, San Francisco, Calif.; "Finance"—Edwin J. Duszynski, Director, Department of Public Works, Appleton, Wisc.; "Personnel"—Sam-

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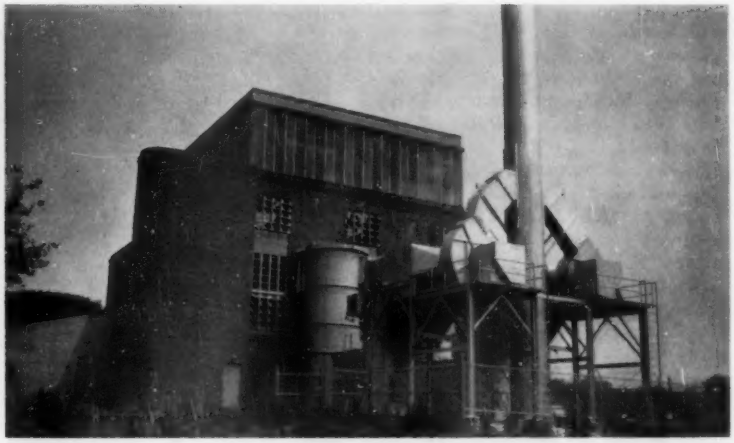
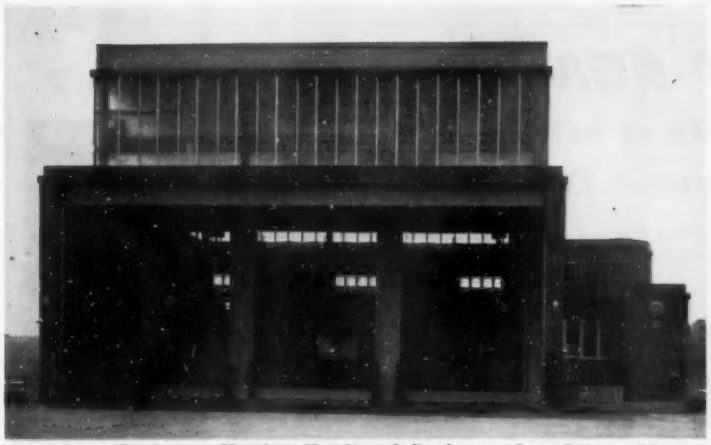
The town of Belmont, Mass. is the first to have it!





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THE TOWN OF BELMONT, MASS.
The new features shown in the equipment picture are the arrangement of cylindrical combustion chambers with spray towers, dust collectors and induced draft fans.

Ask about . . . Vertical spray chambers for low cost fly ash elimination . . . two speed induced draft fans . . . new rotary stokers . . . non-clog dust collectors . . . readily accessible charging gates . . . smaller incinerator buildings . . . safety features and controls never used before for municipal incineration. Write for Bulletin 111-D—The Cylindrical Mechanical Stoker with automatic, continuous, positive stoking.

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uel G. Gentile, Administrator, Department of Public Works, Detroit, Mich.; "Public Relations"—J. H. Davis, City Engineer, Salem, Oregon. Each 10-minute paper will pose questions to be considered at round table discussions. Mimeographed forms will be provided so the discussion leaders can record pertinent comments for transmittal to the speaker who will present a summary report of the group discussion at the closing session.

There will be a reception, courtesy International Harvester Company, Wednesday evening. This will be followed by the APWA 65th Anniversary Celebration. Presiding will be William D. Hurst, City Engineer, Winnipeg, Canada, President of the American Public Works Association.

The local committee headed by Roy Morse, Chairman, Seattle Board of Public Works and City Engineer, has "left no stone unturned" in preparing the way for Seattle's role as Host City. You will enjoy a tour of scenic Seattle, a salmon barbecue get-acquainted party and other entertainment in good old APWA tradition. The ladies program has been given particular and special attention by the committee and features such diverse attractions as a dissertation on "Birdwatchers" and a "Glamorize Yourself With Color" talk augmented by demonstrations with live models.

It's not too late to make your plans. For Hotel and Motel reservation forms and additional information write APWA, 1313 East 60th Street, Chicago, Ill.

Washington State Chapter Elects

Port Angeles, Wash.—Chester L. Waggener was elected President of the Washington State Chapter, APWA, at the Annual Chapter Meeting held in Port Angeles, Washington, June 9 and 10. Mr. Waggener is City Administrator of Moses Lake, Washington. He succeeds Roy M. Morse, Seattle City Engineer, who has been chapter president for the past year.

● **WASHINGTON State Chapter's incoming president Chester L. Waggener (left) is congratulated by the immediate past president, Roy Morse of Seattle.**

A very successful meeting was held during the two-day period with approximately 100 members and guests attending. A talk on "Engineering Services a City Should Provide to its Public" by Glen Sherwood, City Engineer of Kent, Washington, opened the program followed by talks by Earl Siebley, Materials Engineer and G. A. Reidesel, Highway Research Engineer, both of Industrial Research, Washington State University, discussing "Value of Soils Testing" and an "Appraisal of City Needs."

Phil Royal, Principal Engineer, Seattle Engineering Department, discussed the "Effect of Recent Legislation on Public Works," a report on the activities of the state legislators during earlier sessions.

Earl Elton, City Engineer of Bremerton, Washington, talked on "The Use of a Penalty Clause—How Much and When" with regard to city contracts for public works.

TRUCO® DOES IT AGAIN!!! Test cores 4" x 7"

at 15% of previous cost with

Truco Portable Diamond Drill

JOB: Drill reinforced concrete sewer pipe for test cores 4¼" x 7" deep to be used in determining the compression strength of the concrete.

JOB SITE: Lock Joint Pipe Co., Chicago.

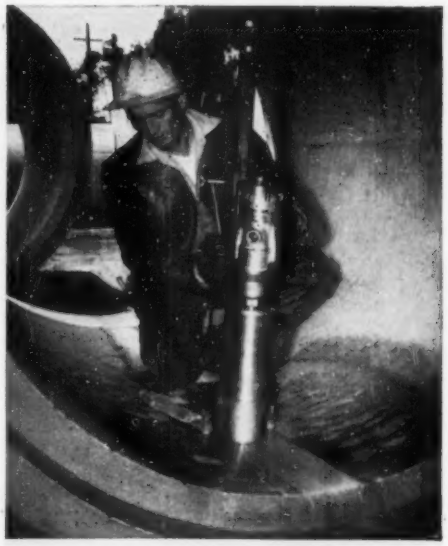
DRILLING CONTRACTOR: State of Illinois Highway Dept. Testing Laboratory.

TOOLS: Truco Heavy Duty 500 rpm Hand Drill Motor with integral Truco Water Swivel and Truco Diamond Drill Bit 4¼" O.D. The drill motor is mounted on Truco Model S Drill Stand.

OPERATION: The equipment is set up inside the 72" sewer pipe and the drill stand is anchored in position by jacking the telescoping shaft within the column against a piece of 4" x 4" to the ceiling of the sewer pipe. This gives rigidity and excellent leverage for high speed drilling.

DRILLING TIME: Set up time is only 2 minutes per core and actual drilling time is 4 to 6 minutes per core. The first Truco Diamond Drill Bit completed 100 holes at 15% of previous cost including labor. Subsequent Truco Drill Bits are giving equally satisfactory performance.

Truco is the first, largest and most complete line of masonry diamond drilling equipment in the world. It can bring you savings up to 70% and pay for itself on a single job or in a single day.



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Experience, acceptance, attractive design—these are the reasons why Union Metal is first in lighting pole sales throughout the nation.

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NEW M-B CONTAIN-O-PACK®

THE MOST FLEXIBLE

CONTAINERIZED SYSTEM

The new self-loading M-B Contain-O-Pack beats all other methods of handling multiple point waste collection. Here's proof: The powerful 3000 lb. capacity side loader with *extendible* boom can *reach* containers on loading docks, over curbing, between cars, over fences . . . faster and easier than *any* other system. The loading boom folds neatly out of the way, allowing hand loading through the side door at any time. Trucks with any cab style—standard chassis—can be used. Does not require fish-plating or other expensive truck modifications. M-B offers three standard sizes of containers —1½, 2 and 3 cu. yd.—in various unique styles. Special sizes and shapes are available. End dumping door on box opens automatically only when container is in position to empty . . . prevents scattering of refuse. The time-proved M-B Packer Body packs anything, in bodies up to 38 cu. yd. in capacity . . . has positive "push-out" unloading . . . assures lowest cost per yard performance. There's a lot more to the full, profitable story. Call your distributor or the M-B Corporation, New Holstein, Wis.

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LINE MARKERS PACKER BODIES SWEEPERS

"Water System Analysis" was the subject of the talk by J. Garth Anderson, Assistant City Engineer of Moses Lake. This was a discussion of the increased demand on water systems due to large population growths.

During the closing business session, in addition to the election of officers, committee reports were given on construction standardization, storm sewer financing, membership and public works recruitment. Roy Morse, General Chairman of the 1959 Congress to be held in Seattle, summarized preparations to date, and outlined the activities that are planned for the delegates.

Alabama Chapter Issues "In The Works"

Birmingham, Ala.—The first issue of the Alabama Chapter's monthly Newsletter "In The Works" was distributed in July. The initial issue consisted of a single sheet mailing piece featuring the "President's Paragraph" which was devoted to the importance of APWA membership in meeting today's public works problems. Also included were "Safety Facts" by "Freeway Freddy" who says that "the fellow that drives fast past the school house is probably the guy that was slowest getting through it."

• • •

Roads in Montana

The Montana Highway Department System is composed of 10,685 miles, of which 5759 miles are on the Primary System, and were built with the aid of Federal Funds but are maintained by the Montana Highway Department. The Secondary System of "Farm to Market" roads is made up of 4936 miles, with Federal funds being used to construct these roads, but with the task of maintaining them left up to the counties wherein they are located.

There are 62,506 miles in the network built and maintained by counties and individuals; of these 17,327 miles are classified as primitive roads and used infrequently. Ungraded dirt roads comprise another 15,669 miles; while graded dirt roads add another 13,286 miles. Roads that are graded, drained, and graveled add up to 15,408 miles; bituminous roads using the penetration method total another 363 miles; and plant mix bituminous surface roads add 444 miles. There are 7 miles of concrete highway on the local system.

Available with pushbutton platform controls, too

Push a button and the new Holan Series 2600 Ladder goes up; push another button and it comes down. The pushbutton station is on the mast—and a station can be installed on the upper side rail for the man on the platform.

Pushbutton control is just one operating feature. For precise spotting, you have a needle valve with a long handle that enables you to accurately guide the ladder down. You rotate with a crank located directly behind the ladder; this provides a better view for spotting, avoids left-hand cranking and gives maximum clearance between body wall and ladder. And, you crank the fly ladder out *and in* with a windlass.

Important non-operating features include: light-but-strong tubular support frame; heavy duty ladder hooks that engage two rungs at a time; optional protective fiberglass covering on side rails; and optional metal rungs. Heights to 32 feet, 360° rotation, 72° elevation.

Holan Corporation, 4100 W. 150th St., Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Ariz.

Holan

Subsidiary of THE OHIO BRASS COMPANY

new model H-50 joins.

5,000 lb. carry capacity...3/4 to 2 yd. buckets

The model H-50 is the successor to the model HU in the "PAYLOADER" line of 4-wheel-drive tractor-shovels, and is another example of the continual development program that has maintained Hough leadership in tractor-shovel design and performance. The model H-50 contains a number of improvements that give it outstanding performance for a machine in this size range.

Full 5,000 Lb. Carry Capacity

You can lift loads of 7,000 lbs. to maximum dumping heights, and can CARRY LOADS up to 5,000 lbs., which means you can use buckets up to 2 cu. yd., depending on the materials to be handled. The bucket tips back low and close — with better balance and stability and with less spillage.

More Power

The H-50 gives you a choice of gasoline or diesel engines and more horsepower in both types — 92 hp gasoline, 90 hp diesel. These bigger engines provide more power for both propulsion and hydraulics without "lugging down".

Easy, Full-Power Operation

Power-shift transmission with three speeds forward and reverse, plus easy power-steer and 4-wheel power brakes, assure fast operation with minimum operator effort . . . promote a high production rate the full shift.

Full Protection for Long Life

The brakes of the front wheels are sealed to prevent scoring and glazing by foreign matter. Large oil-bath air filters and cartridge-type oil filter protect the engine. Two cartridge-type oil filters protect the hydraulic system oil and the transmission-torque converter oil.

More Attachments...More Uses

The widest choice of attachments are available, including these exclusive ones: Drott 4-in-1 bucket, Wain-Roy Back-hoe, Vibratory compactor, Ram Black-top spreader . . . also blower, "V" and blade snow plows, angling back-filler, back-rip scarifier, winch and others.

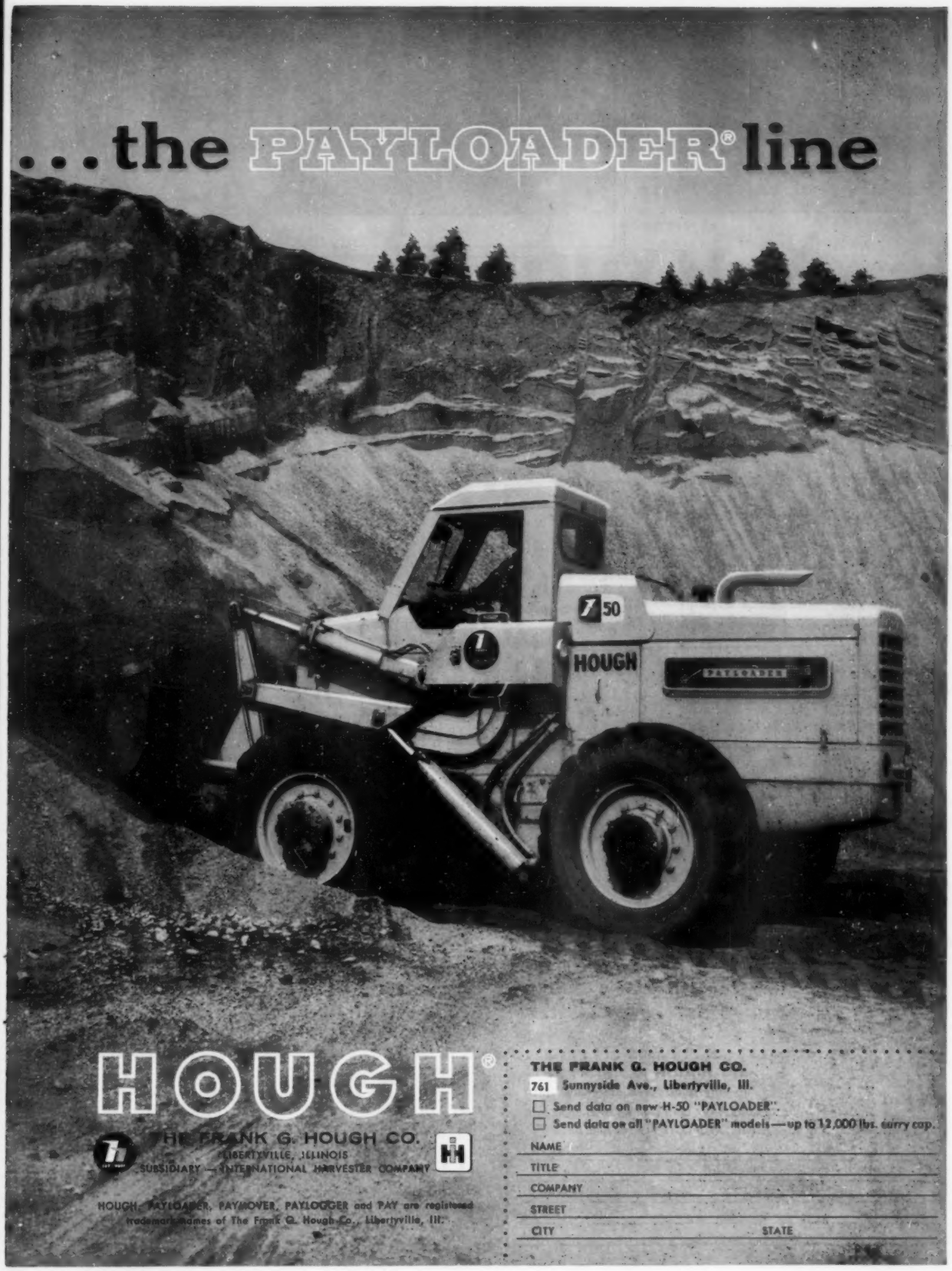
YOU CAN IMITATE APPEARANCE BUT YOU CAN'T DUPLICATE EXPERIENCE

Model H-70: 7000 lb. carry capacity; 1⅛ to 3½ cu. yd. buckets; gas or diesel engines — 110 h.p.

Model H-90: 9000 lb. carry capacity; 1½ to 5 cu. yd. buckets; gas or diesel engines — 122 to 162 h.p.

Model H-120: 12,000 lb. carry capacity; 3¾ to 6 cu. yd. buckets; 300 h.p. diesel.

...the PAYLOADER® line



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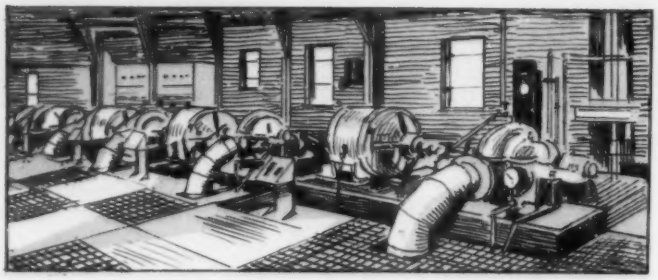
THE
WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Filter Hydraulics

Cities are finding that, as per capita water consumption continues to increase, their filtration plants must be operated at maximum capacity for longer periods during the summer months. If the filters are to operate satisfactorily and the clear well capacity is to be fully utilized during periods of maximum plant output, a thorough investigation of head loss from the filters must be made. In order to establish design criteria for the proposed 100-mgd East Side Plant for Dallas, Texas, the hydraulic conditions existing at the Bachman and Elm Fork water treatment plants were thoroughly analyzed. Investigations at the Bachman plant showed that during summer periods of 100 mgd maximum output at a 4.0-gpm per sq. ft. filter rate, the set rate through the filter rate-of-flow controllers cannot be maintained beyond approximately 3.5 feet loss of head when the clear well is at a maximum level or full. In other words, the filtration rate will begin to decline as the sand bed becomes dirtier resulting in exceedingly short filter runs and requiring excessive backwashing in order to maintain the maximum rate of filtration. Another condition which compounded the problem during maximum filtration, was that adverse pumping conditions impose another limiting factor on the clear well reserve supply when a reserve is needed most. The water depth in the clear well must not fall below approximately 10.0 feet in order to prevent the pumps from breaking suction and to maintain maximum pumpage. Thus, between the levels required in the clear well for maximum filtration and that for maximum pumpage operation, the reserve supply in the clear well, for all practical purposes, is reduced to zero. These and other hydraulic conditions have been thoroughly investigated in the two present filtration plants to overcome the objectionable factors found in these plants when the new East Side Water Filtration plant is designed and built.

"Filter Hydraulics Affect Clear Well Design." By Frank G. Honeycutt. PUBLIC WORKS, August, 1959.

San Francisco's New Reservoir

San Francisco's new Sunset Reservoir-South Basin will add 87.3 million gallons to storage when completed this fall. This will be the largest of the five primary distribution reservoirs and is 1,021 feet long by 501 feet wide with the depth varying from 31.5 feet at the over-flow line, at the deepest point, to 28.5 feet at the shallowest point. The design of the reservoir lining called for 2 inches of plant mix which provided a smooth base for a ¼-inch catalytically-blown asphalt membrane, followed by a 4-inch concrete slab. All construction joints and additional dummy joints formed with beveled wood strips are filled with a mastic joint sealer. The roof, with 498,375 square feet of area, was designed for a 50-lb/square-foot live load. It rests on a 25-foot grid system of 22-inch- and 24-inch-diameter columns capped with 24-inch-deep girders and 10-inch deep joists under a 3-inch slab and is designed for earthquake loading with the columns carrying the side thrust and the roof girders permitted to slide on the supporting crest beam around the perimeter of the reservoir. The author describes the blasting and construction phases of this project and relates some of the experiences of blasting in a residential neighborhood especially from a public relations standpoint. Total cost of Sunset Reservoir-South Basin was $2,783,160.

"More Than Engineering Needed." By J. H. Turner. *The American City*, July, 1959.

It Took Three Elections

A much needed and long overdue water-improvement program costing $2,600,000 promises relief to at least the most critical areas within the City of Great Falls, Montana.

● **WATER AND SEWAGE plant award winners in Florida: First row, left to right: J. M. Logan, C. M. Courson, David B. Lee, S. P. Robinson, W. C. Tims. Rear, Paul Samuels, J. T. Hoffman, P. A. Cessna, Dries Vandenburg, T. E. Wagoner, J. N. Hagerich.**

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has ALL these features...

★ *Optional ground line break flange*
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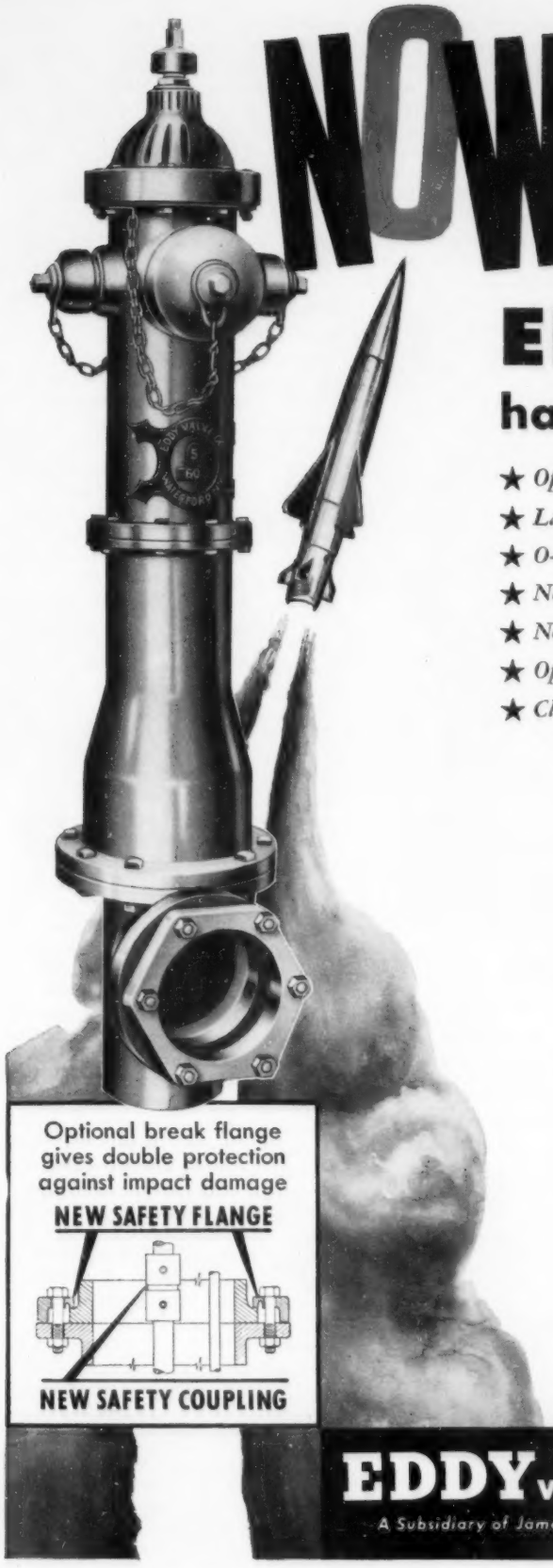
★ *O-ring or standard packing*
★ *New self-sealing rubber ring main valve packing*
★ *No lubrication required for fast, easy opening*
★ *Opens with the pressure—for instantaneous flow*
★ *Closes against the pressure—eliminates water hammer*



Optional break flange gives double protection against impact damage

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The EDDY Hydrant...improved... streamlined...modernized...retains all the basic advantages that have made these hydrants outstanding for four generations. Yet, it has important new advanced design features which provide the utmost in efficient, dependable, longlife fire protection service.

These new important advantages are provided without sacrificing interchangeability of working parts with EDDY hydrants now in service. Now, more than ever, EDDY offers maximum fire protection, economical maintenance and assurance against future obsolescence in your fire-fighting system.

Before buying or specifying hydrants, be sure you know how these advantages may benefit your community.

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WATERFORD NEW YORK

Persistent leadership by the city council overcame stubborn opposition to this badly needed water-improvement program. In early 1957, after two bond issues had been disapproved by large majorities, the administration appointed a Cross-town Water Advisory Commission consisting of representatives of labor, business, the Chamber of Commerce and housewives to study the critical water situation. After this Commission had studied all phases of the problem and informed the citizenry via radio, television, newspapers, club meetings and on-the-street discussions, the $2,600,000 bond issue was approved by a 3 to 2 vote. The program comprises nine basic contracts, some of which have already been completed, others are under construction and several are in the letting stage. Some of these contracts are as follows: 1) Equipping two existing rapid sand filters. 2) Erection of a 750,000-gallon steel tank. 3) Replacement of a 24-inch raw water line with a 30-inch line. 4) Laying of 17,900 feet of 24-inch pipe, 7,550 feet of 20-inch and 400 feet of 12-inch pipe. 5) Construction of a booster station with three pumps of 4.3 mgd capacity each. 6) Additions to the filter building to house four 2-mgd filters, a 300,000-gallon clearwell, a new clarification basin with Link Belt flocculation and sludge-removal equipment and other equipment. The citizens of Great Falls will be paying about 75% more for their water but they have taken a big step forward toward solving their problems.

"It Took Three Elections." By Del V. Brick. *The American City*, July, 1959.

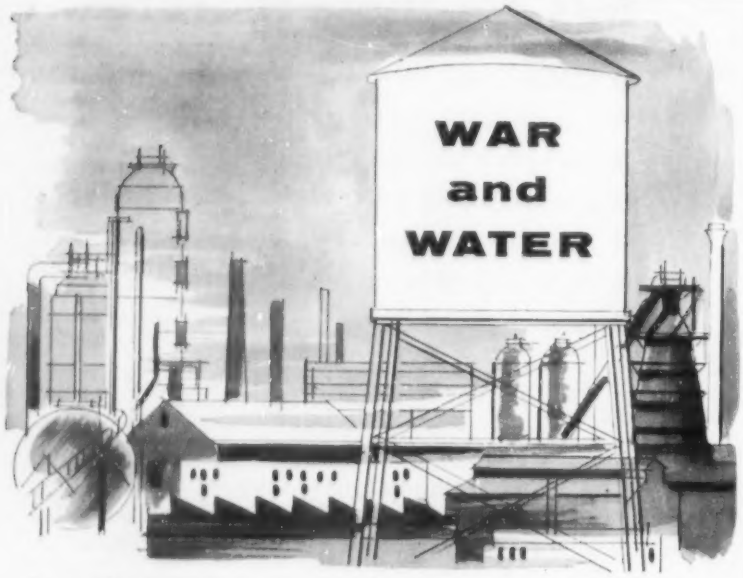
Chicago Rebuilds Sand Filters

Removing, regrading and replacing about 16,000 cu. yd. of sand and gravel in 80 rapid sand filters is a major job facing Chicago's Water Department during the next few years. Hydraulic methods will be used as much as practical in removing sand and gravel from a filter, rescreening it, and returning it to the filter. The first full scale experiment was performed on a filter during the winter of 1957-58. From the experience gained in removing gravel in this test, it was apparent that a pump with an 8-inch suction and 6-inch discharge was needed. The pump transports the material in water under pressure to a sand and aggregate screening machine and then back to the filter. In rebuilding the filters, very little additional gravel will be needed except that required by new filter design, but considerable new sand will be needed to replace that lost through backwashing. This sand will be transported to the filter plant in railroad hopper cars and pumped a maximum distance of 1,100 feet to the filters. One filter has been almost completely rebuilt. A second filter incorporating a new design of sand and gravel has been placed in service. A third may be built this winter. No schedule has been set for rebuilding the other filters in the 320-mgd filtration plant but they will be rebuilt over the next few years. A number of photographs and sketches accompany this article.

"How Chicago Plans to Rebuild Rapid Sand Filters." *Engineering News-Record*, July 9, 1959.

Treatment Processes

The Detroit Department of Water Supply has three large water treatment and pumping stations which supply Detroit and 46 surrounding communities, or approximately 3,200,000 people. The newer plants have been equipped with mechanical mixers, flocculators, adequate



Domestic uses amount to only about 3% of U. S. annual water consumption.

During "cold" war maneuvers and real war rumors, it is well to remember that industrial water is a basic resource in national preparedness and in war. Entirely apart from human needs, without industrial water supply there could be little or no production of war materials.

Industrial production requires over 5 billion gallons of water daily. Inadequate water supply could cripple or kill industrial operations as they can knock out a man. The basic materials used to make aircraft may be metals, but the metals themselves could not be produced without the use of water. It takes 150 tons of water to make 1 ton of steel.

When you see a military airplane soar through the air, or read of the latest missile shot to the moon—remember that behind the scenes, unsung and perhaps unknown, were the engineers and management of a modern water works system.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE
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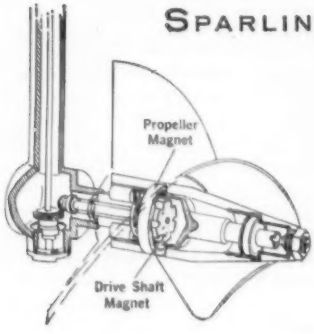
TOTALIZATION *and* RATE OF FLOW *at a glance*

SPARLING **MASTERFLO** MAIN-LINE METERS



DIRECT TOTALIZATION is the primary function of all Sparling Meters. The SPARLING MASTERFLO also shows *rate of flow* to give *complete* flow information instantly, accurately and continuously without the use of conversion tables or secondary instruments.

SUPERIOR PERFORMANCE of the MASTERFLO meter is a result of Sparling's exclusive magnetic drive. A combination of magnets in propeller and drive shaft permits entire gear box to be hermetically sealed. Vital parts are protected from corrosion, and without packing glands, friction is negligible. Accuracy is assured; maintenance is reduced; meter life is extended.

SPARLING MASTERFLO MAIN-LINE METERS represent the most advanced metering equipment in the water works field. Sizes 4" to 24" and suitable for 150 or 250 psi working pressure.

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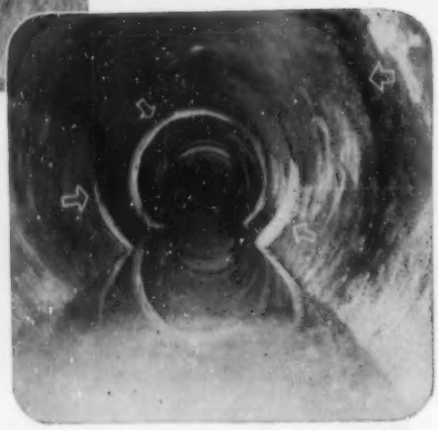
SPARLING METER COMPANY *225 N. Temple City Blvd., El Monte, California*

Atlanta 3 • Chicago 4 • Cleveland 13 • Dallas 1, Tex. • Denver 6 • Kansas City 6, Mo. • Roselle, N. J. • San Francisco 24 • Seattle 99 • Romford, England

Costly waste, 20 gallons of water per minute

BEFORE

STOPPED with WATERPLUG Hydraulic Cement



AFTER

Waterplug stops running water INSTANTLY!

Here is what Underwater Services, Valley Station, Ky., had to say about Waterplug

On October 6, 1957, our Underwater Services Company was called upon to repair a major break in an underwater drainage system for the Hardin County Sportsmen's Lake at Elizabethtown, Kentucky. Upon diving to the bottom of the lake we discovered several large ruptures in the 24" tiles used in the drainage system. Water, uncontrolled, was pouring through these breaks at a minimum approximate rate of 20 gallons per minute. Using underwater diving equipment we managed to reduce this torrent by packing sandbags into the holes channe'ed through the four feet of earth covering these tiles. Descending through a water control tower, we gained access to the interior of the drainage tiles to the area of break-through. Above us were four feet of lake bottom and 20 feet of water above that. Under these extremely adverse conditions we used the Thoro System WATERPLUG Cement to repair the breaks from the interior of the tiles.

Because of the simplicity and ease of mixing and applying WATERPLUG Cement, we were able to completely and effectively repair these breaks in the drainage system.

We were delighted with the effectiveness of WATERPULG Cement in successfully overcoming this difficult water repair problem. Feel confident that in future underwater repair problems, our company will rely upon WATERPLUG Cement.

Just off the press, write for our NEW 20 page brochure

Standard Dry Wall Products Inc.

BOX X, NEW EAGLE, PA.

settling basins and surface wash facilities. Detroit's source of raw water is Lake St. Clair where it enters the Detroit River. This supply is frequently subjected to slugs of industrial pollution of a phenolic nature. By adding a pre-chlorination dose of chlorine long before the raw water reaches the plant, a longer contact period is provided, so as to eliminate taste and odors. Carbon is fed as a slurry at each plant to help eliminate tastes and odors. It is purchased in railroad hopper cars, slurried in large underground concrete tanks, and pumped to day tanks where it is fed by rotadips. The advantages of feeding carbon as a slurry lie in its cleanliness, ease of handling, low handling costs, and accuracy and control of the amount fed. Detroit has been using liquid alum at one of the treatment plants since 1953 and this proved so successful that all of the plants were converted to the use of alum in this form. Since 1924, Detroit has had 24-hour-a-day, 7-day-a-week laboratory control over filtration and treatment processes. Recently, because of the increasing incidences of flash industrial pollution at the raw water intake, professionally trained engineers or chemists have been installed as supervisors on each shift with complete responsibility for the shift. Routine monitoring of the radioactivity of the raw water is being planned now that the most modern type of low-level detection equipment has been purchased and a radioactivity laboratory has been established.

"Control of Treatment Processes." By Dr. A. M. Shannon. *Water Works Engineering*, July, 1959.

Storage Tank Repair

A study of twelve different methods of repairing a 50,000-gal. riveted overhead storage tank in Lansing, Mich., indicated that the use of reinforced epoxy resins would be the most economical. This method of repair is expected to result in minimum maintenance for the coming years and can be used not only to repair an old tank but also to protect a new one, thereby reducing the need for maintenance and prolonging the useful life of the tank. Prior to applying the resin, the tank metal surface must be cleaned thoroughly by sandblasting, reaching the bare metal. Where any large holes are exposed, a 3/16 in. steel patch should be welded to the tank. It is not necessary to plug the pin holes that result from sandblasting. In this case, the first coat

FLUIDICS

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the know-how
the equipment
and the experience
for solving problems involving fluids

Permutit valveless filter, municipal design

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FLUIDICS AT WORK

The only filter that works by itself

We sell most of our Permutit valveless filters simply by pointing out the things you *don't* have to do and the things you *don't* need once you install one:

Manpower—None needed. No valves to operate, gauges to watch, pumps to start or stop, or decisions to be made.

Valves—None. Entire operation is automatic and hydraulic.

Pumps—None needed. All work done by atmospheric pressure.

Rotary wash—None needed. Unit operates only to four- or five-foot head . . . schmutzdecke cannot become packed enough to need breaking up.

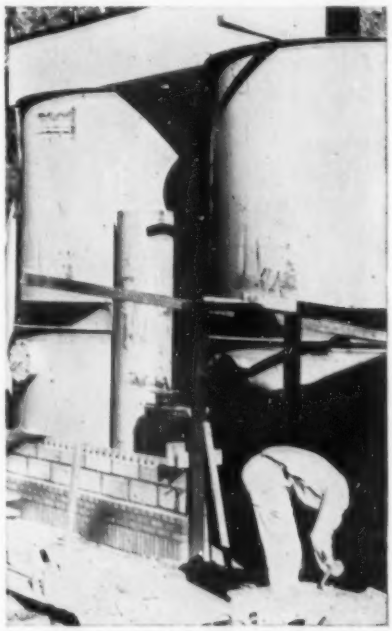
Flow controller—No mechanical, pneumatic, or hydraulic devices needed . . . unit filters whatever volume you deliver.

Maintenance — None, outside of normal, routine painting. No moving parts to wear out.

The best part of our story is the fact that this filter costs less than conventional gravity filters, either manual or automatic.

The basic laws of hydraulics behind this filter's design show in the diagrams. If you're rusty on your hydraulics, or are just plain interested, we invite you to write for our bulletin on valveless filters.

Address yourself to our Permutit Division, Department PW-99 50 West 44th Street, New York 36, New York.



Automatic valveless gravity filters, like this tandem setup photographed during its installation at an Eastern municipality, are now in service.

of epoxy resin was applied to the entire interior surface. The second coat and those coats applied between the layers of glass fiber were heavily pigmented to assist in filling the voids in the glass fibers. The second coat, consisting of pigmented resins, was applied to small areas, approximately 4 x 5 ft. While this coat was still tacky, the fiber glass fabric was applied. After the first layer of glass fabric was imbedded in place, another coat of pigmented resin was applied to saturate the fabric thoroughly. Then the second layer of glass fabric was applied. The final coat was of clear resin to provide a smooth, dense surface impervious to water. The total thickness of the lining thus applied should be approximately ⅛ in. where two layers of glass fabric are used.

"Storage Tank Repair With Plastics." By C. R. Erickson. *Jour. A. W. W. A.*, July, 1959.

Distribution System Extensions

The first step in properly designing additions or reinforcements to a distribution system is to establish the criteria upon which the design is to be based, that is, to determine the maximum demand of water which must be supplied during the design life. The maximum demand will be one of two quantities, either the maximum hour consumption of the maximum day or the maximum day consumption plus the maximum fire flow requirement. The best method of predicting future water quantities is to base it on population which must be determined accurately in the area of a city in which an extension is being planned. The water consumption in the system, as recorded by the master meters, is also important for design purposes. By correlating population with past consumption, per capita consumption can be determined. In addition, tests should be made in the system to determine how the system operates, the internal condition of the mains, the amount of water available for fire protection, amount of leakage and waste, etc. Leakage wastes main capacity, pump capacity and purification capacity, and benefits no one. Once the water quantities for the design have been established, the next step is to design reinforcements or extensions to the system. There are several methods by which a distribution system can be reinforced. 1) Rehabilitation of mains by cleaning and/or cleaning and cement lining. 2) Installation of booster pumping. 3) Erection of elevated storage. 4) Construction of ground storage and repumping stations. 5) Installation of additional mains.

"Design of Additions to Distribution Systems." By W. D. Hudson. *Water & Sewage Works*, July, 1959.

Valve Replacement

The Bridgeport Hydraulic Co. is a private water company serving seven cities and towns in lower, western Connecticut, comprising a population of approximately 291,000 people. Most of the distribution system in the downtown Bridgeport area is at least 50 years old, and it was in this section that a major valve replacement program was undertaken in the spring of 1958. Through a periodic valve inspection and testing program, it was discovered that several of the main line valves in the principal business area were defective for one reason or another and could not be relied upon to hold water in the event of a major break. After thorough investigation it was decided that it would be necessary to shut the downtown business area down, remove the defective valves

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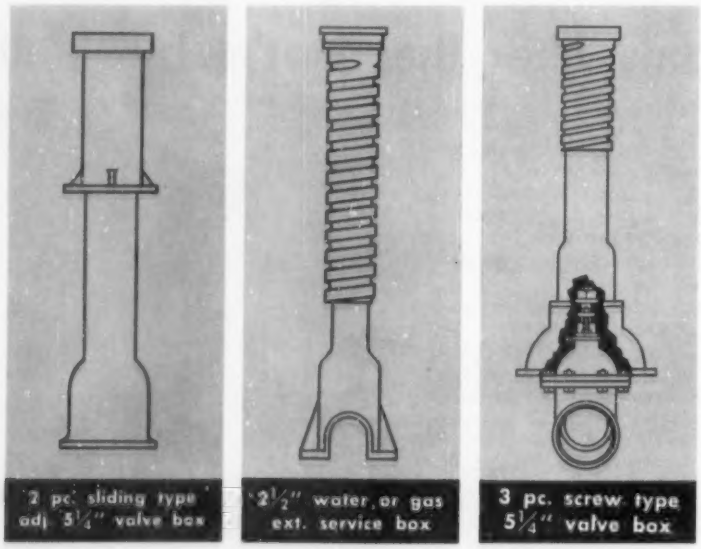

2 pc. sliding type adj. 5¼" valve box

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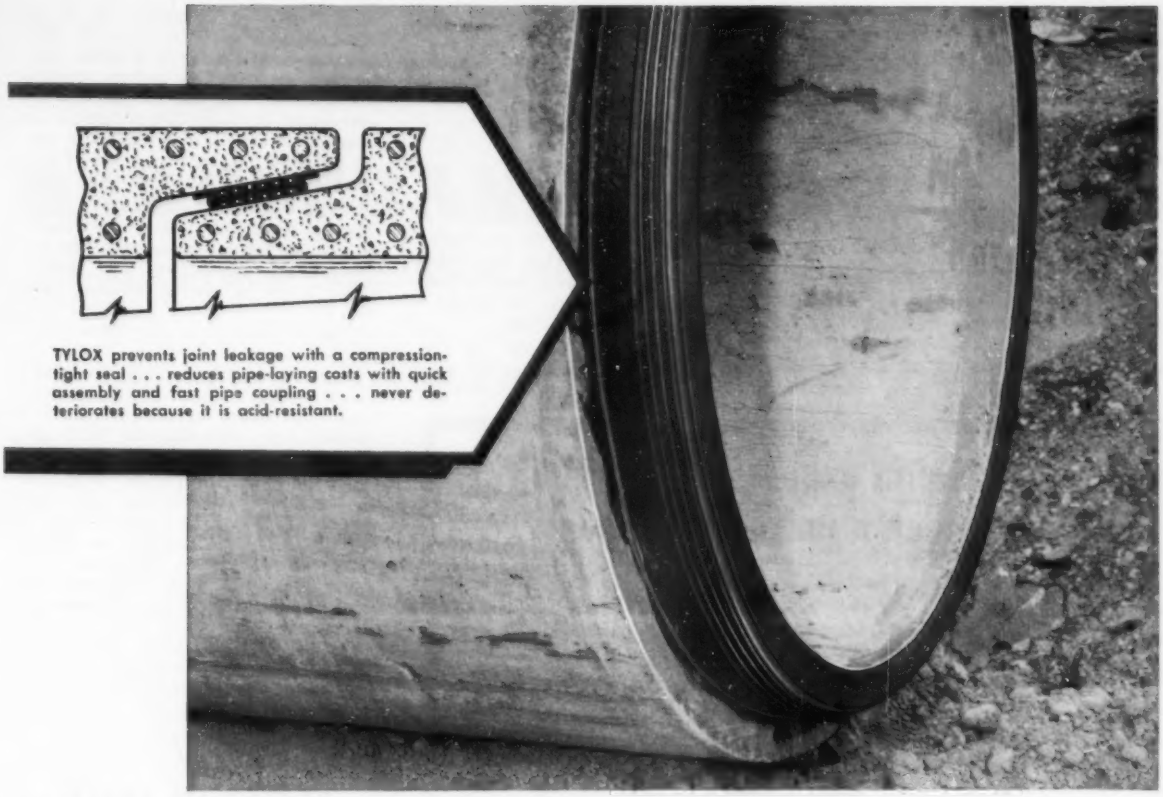

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and replace them with new ones. When detailed plans had been worked out by means of complete trial shut-out during the night hours, all of the agencies that were to be involved were appraised of the situation. All customers were notified at least one week prior to the actual shut-out and, where necessary, arrangements were made for a temporary supply to be provided. The actual replacement of the valves was carried out by dewatering the mains involved, the pipe was cut by means of Wachs pipe saws and the gate valves lifted out and a new unit dropped into place. From this point on, the entire job was merely a matter of routine.

"Valve Replacement." By Kenneth E. Bender. *Water & Sewage Works*, July 1959.

Other Articles

"Fifty Years of Advancement in the Knowledge of **Water Substance.**" A report on the advances in knowledge of the chemical properties and those physical properties intimately related to its chemistry. By A. M. Buswell. Jour. A. W. W. A., July, 1959.

"Colloids and Conductivity." A discussion of the specific electrical conductivity of turbid waters and its relation to effective coagulation. By W. G. Woxholt. Jour. A. W. W. A., July, 1959.

"Economic Boundaries of Saline Water Conversion." The author explores the economic feasibility of saline water conversion in terms of its ability to compete in cost with established water supply techniques. By Louis Koenig. Jour. A. W. W. A., July, 1959.

"Coagulation, Introduction and Theory." Part I of a series of 3 articles on coagulation. This one concerns the theory of coagulation. By Marvin Lane. Water & Sewage Works, July, 1959.

"Current Affairs in the **Water Supply** Service in England and Wales." A comprehensive discussion of the affairs of the water works industry in England and Wales. By Charles A. Risbridger. Jour. New England W. W. A., June, 1959.

"Controle de la Qualite de L'Eau de Londres." (Supervision of the Quality of Water in London) par E. Windle Taylor. La Technique de L'Eau, Juni, 1959, Bruxelles, Belgique.

"Etat Actual de la Normalization des **Analyses D'Eau** et de L'Expression de Leurs Resultats." (The Present State of Standardization of Water Analyses and the Expression of Results). par M. Maurel. Techniques et Sciences Municipales, Mai, 1959. Paris, France.

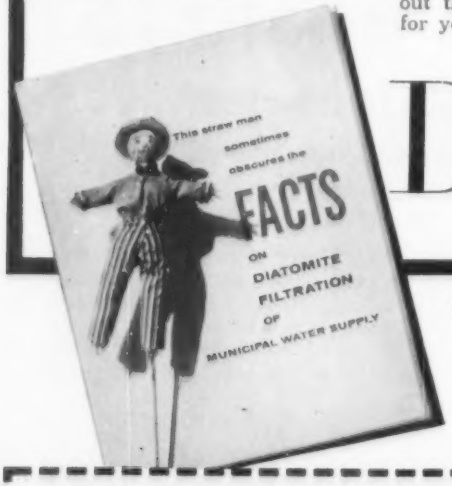
This bulletin exposes a bogeyman who's been a nuisance for years.

Have you read it?

We believe that anyone concerned with potable water supply will find this recently published bulletin both interesting and rewarding, because it discusses (and corrects) two common misconceptions on diatomite filtration.

Only 4 pages in all, this bulletin does not pretend to offer complete coverage of diatomite filtration for municipal water supply. But – briefly, readably and factually – it establishes the positive advantages of diatomite filtration... lower capital investment, smaller space requirements, brilliant clarity even with variable raw water, and ease of operation.

If you haven't read this informative folder, why not fill out the coupon below – now – for your copy.



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BOOKS IN BRIEF

NATIONAL WATER QUALITY NETWORK

A cooperative effort is being carried on by Federal, State and local organizations to record the water quality characteristics of surface water at selected locations in the nation. This is the first annual report on a project which is intended to show what is happening to the quality of our surface waters. After showing the network of sampling stations, the report gives data on radioactivity, plankton population and organic chemicals and records results of chemical, physical and bacteriological analyses. 240 pages; $1.50 from Superintendent of Documents, Government Printing Office, Washington 25, D. C.; compiled by the Public Health Service.

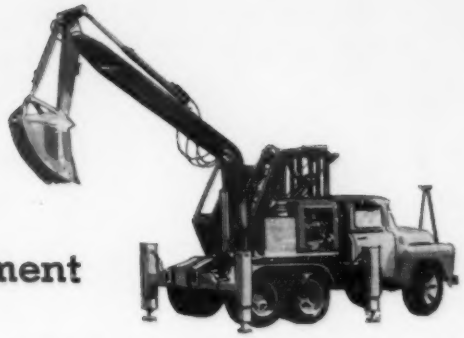
WATER FACTS FOR THE NATION'S FUTURE

This is an interesting and thoughtful study of our present situation regarding water needs and uses. It is written in part to emphasize the necessity for collecting more factual information in regard to water—hydrologic and hydroclimatic data; and in part to indicate the need for better water management. The latter will come mainly from having

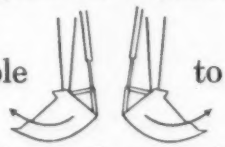
This is a

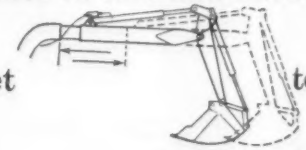
HYDROCRANE

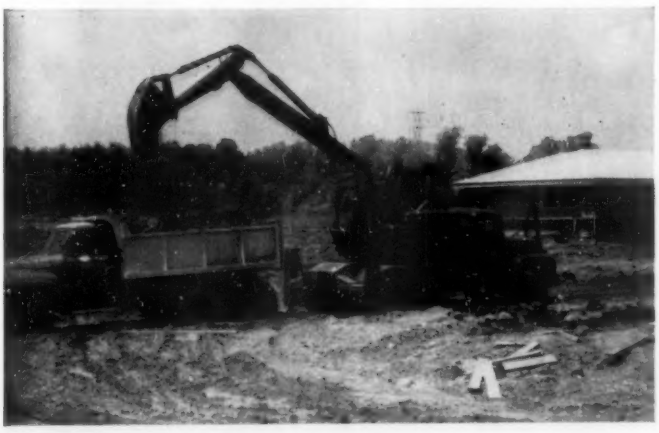
...with a Hydrohoe attachment



and you can bet it's going to DIG because behind the teeth on that bucket is a combined total of 189,000 pounds of ram force! This machine has a combination of features that put it in a class by itself among half-yard hoes.

Here's why: The dippers for Hydrohoes, ranging from 24 to 60 inches wide, are reversible  to give you two-way digging action.

Also, the dippers have hydraulic wrist action to bite in fast and hard. The boom on this hoe telescopes 4 feet  to give you efficient dumping reach for every job, eliminating unnecessary move-up time.



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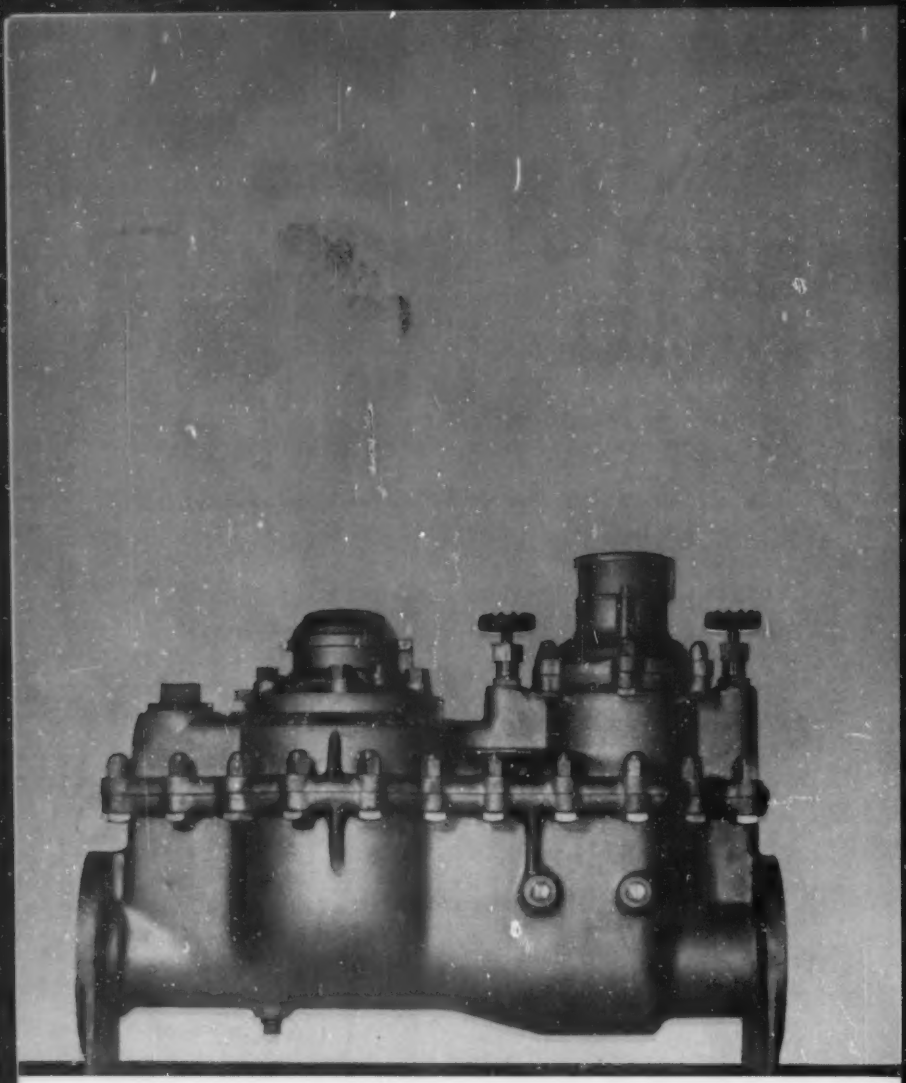

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HERSEY 1859 1959 100 YEARS OF PROGRESS

available more data on rainfall, runoff, stream flow and related matters. Among the many matters of interest is the analysis of existing programs for gathering water data and the deficiencies and needs that still exist. Part I treats of the gathering and publication of data; Part II covers "data in action"—the use of information in irrigation, flood control, water supply and waste disposal. This is a Conservation Foundation study. The authors are Walter B. Langbein and William G. Hoyt. The Ronald Press Co., 15 East 26th St., New York 10, N. Y.; 24 figures; 8 tables; 9 appendices; bibliography; 269 pages; $5. Highly recommended.

WATER UTILITY MANAGEMENT MANUAL

A Manual on Water Utility Management has just been published by American Water Works Association, 2 Park Ave., New York 16, N. Y. The 192-page volume is the first in a projected series of educational manuals being prepared under the direction of AWWA's Committee on Education. Although designed primarily as a text for management training courses, the Management Manual can also serve as a valuable guide for those already in managerial positions. The 22 chapters cover such key topics as rate schedules, service regulations, legal responsibility, accounting, office operation, safety programs, and financing. Every manager of a water utility—small or large—should profit from reading the Manual. $2.00 a copy ($1.60 to members sending cash with order); for short-school or similar use, a quantity discount is offered on orders of 20 or more.

LANDSLIDE OCCURRENCE AND ANALYSIS

This 43-page bulletin includes three papers presented at the 37th Annual Meeting of the Highway Research Board, as follows: "Regional Concept of Landslide Occurrence," by Robert F. Baker and Robert Chieruzzi, covers the initial phases of a basic study of landslides, under the long-range objective of developing or refining quantitative methods of analyzing the degree of stability of natural slopes: "An Appraisal of Measures for Improvement of Slope Stability," by R. G. Hennes, S. E. Hawkins, and E. L. McCoy, presents several graphs enabling the engineer to estimate the amount of drainage required to achieve a desired factor of safety of an earth slope and the safety factor improvement by benching or reducing the

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These basic advantages are yours when you use Crispin Air Valves . . . simplified construction, easy accessibility, maximum durability, minimum maintenance and efficient operation. You're safe with Crispin Air Valves on the job!

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Crispin NEGATIVE PRESSURE AIR VALVES . . . release air semi-automatically from pipeline siphons to end the danger of throttled pipelines.

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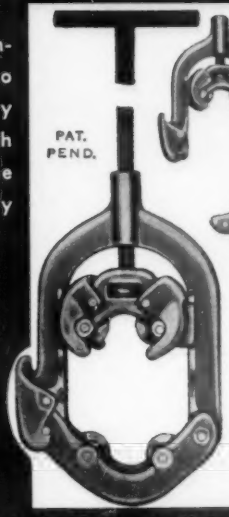
New REED HINGED 4-WHEEL PIPE CUTTERS

Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

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slopes of excavations; and "Computer Solution of Swedish Slip Circle Analysis for Embankment Foundation Stability," by Roger V. LeClerc and Robert J. Hansen, describes a method developed by the Washington State Department of Highways to investigate a given range of slopes. Copies are available from Highway Research Board, 2101 Constitution, Washington, D. C., and are 80¢ each.

SOIL AND MATERIALS SURVEYS BY USE OF AERIAL PHOTOGRAPHS

This 52-page bulletin contains four papers presented at the 37th Annual Meeting of the Highway Research Board, as follows: "The Engineering Soil Survey and Its Relation to Engineering Problems," by A. R. Jumikis, W. W. Holman and J. R. Schuyler; "An Engineering Soil Survey of Fayette County, Kentucky," by R. C. Deen; "Airphoto Analysis of Terrain for Highway Location Studies in Maine," by E. G. Stoeckeler and W. R. Gorrill; and "Gravel Prospecting by Use of Aerial Photographic Interpretation," by R. J. Kasper. Copies at $1.20 each are available from Highway Research Board, 2101 Constitution, Washington, D. C.

CINCINNATI SEWAGE DISPOSAL

The ninth annual report of the Division of Sewage Disposal, Department of Public Works of Cincinnati, O., gives operational information that should be of value to all interested in sewage treatment plants. Sewerage service charges brought in $3,157,936 during 1958, and surcharges amounted to $413,746. Total income amounted to $4,071,740. Considerable space in the report is devoted to industrial waste evaluation and control.

• • •

Municipal Parking

(*Continued from page 97*)

bumper/meter post. A six-inch diameter steel pipe four feet long is set in a 1:3:5 concrete foundation that is two feet square and two feet deep. The remaining two feet of the pipe post extends above the surface of the pavement. The inside of the pipe is either filled with 1:3:5 concrete (bumper post), or a two-inch steel pipe meter post is inserted and grouted inside the six-inch pipe shell (bumper/meter post).

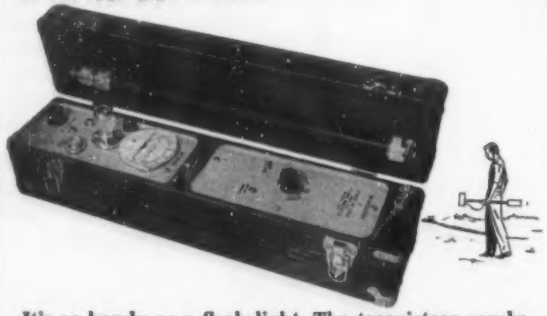
Bumper/meter post installations have several distinct advantages. They not only have long useful lives and almost non-existent maintenance costs; but they also aid in the flexibility of drainage design, provide little opportunity for litter to collect, aid in snow removal, provide a place for a double meter installation, prevent the type of accidents that occur when a person tries to step over bumper rails or curbs and add to the esthetics of the parking lot. The main disadvantage in their use lies in the fact that the longitudinal spacing between them is such that automobiles can pass through them transversely. This disadvantage is of particular importance around the edges of a parking lot, where special care must be taken to keep automobiles off adjoining property.

Raised concrete traffic islands are used when conditions warrant. Constructed of 1:2:3½ concrete, they are seven inches high and are built in the various widths and lengths required by the circumstances governing their selection. In addition to serving as curbs and providing places to mount meters and lighting standards, they also can be used for pedestrian walks.

Concrete curbs seven inches high and bituminous curbs six inches high are used upon other occasions. When they are placed back to back

THE NEW MINIATURIZED WILKINSON LINE LOCATOR MODEL W-3

This radically new, powerful, transistorized locating instrument weighs only 4 pounds and is ¼ as large as old type pipe locators.



It's as handy as a flash light. The transistors rarely, if ever, require replacement; non-leak mercury cells outlast old type batteries at least ten times. The instrument cases are molded glass fibre. The aluminum connecting handle telescopes to 17 inches, and the entire instrument comes in a substantial carrying case.

Write today for illustrated brochure and instruction manual.

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TECHNICAL ADVANTAGES

- 1—Requires an average of 40% less wash water
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FAR SUPERIOR to Sand or Quartz Media, as it Double length of Filter runs, nearly halves wash water needs; with less coating, caking, or balling.

Filters are in service more as wash water cycle shorter. Better removal of bacteria, taste, odor. Increased Filter output, better effluent. Ideal for industrial acid and Alkaline solutions. Ask any user.

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America's lowest-priced 4-wheel drive pickups
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New Ford F-100 4-wheel drive Styleside pickup handles heavy loads and makes its own road.

ALL FORD-BUILT . . . FACTORY-ENGINEERED . . . FOR GREATER SAVINGS!

Go *Ford*-ward for 4-wheel drive performance at big Ford savings. New Ford 4 x 4 Pickups have the power and traction to go most anywhere. They're factory-engineered from the ground up for extra stamina, and all Ford-built with your choice of economical Short Stroke power—Six or V-8.

There's new versatility too, with two power take-off points in the transfer case to drive winches, saws, diggers, or other equipment. And there's new driving ease. You shift smoothly between 2- and 4-wheel direct drives while moving. Ford's *driverized* cab provides new riding comfort and modern styling.

Ford 4-wheel drive trucks are available in ½- and ¾-ton pickups, chassis-cabs and ¾-ton stake models. See your Ford Dealer . . . and save hundreds of dollars on America's lowest-priced 4 x 4's with Six or V-8 engine!

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . LAST LONGER, TOO!

the space between the curbs can be filled with run-of-bank gravel and blacktopped. When constructed in this fashion they serve the same purpose as the raised concrete traffic islands.

Wooden telephone poles and railroad ties held in place with steel pins or small pipes driven into the ground are sometimes used for curbing in parking lots built for temporary use. Although their first cost is relatively low, subsequent maintenance costs and a tendency towards general deterioration make their use in permanent parking lots undesirable.

Two-inch steel pipe parking meter posts are supplied by the Parking Authority and installed by the contractor. Each post is set in a 1:3:5 concrete foundation 12 inches in diameter and 12 inches deep. The top of the post is 3 ft. 4 in. above the surface of the pavement. After the meter post installations have been completed, the Parking Authority installs the meter heads and paints the posts.

Recent bid prices for traffic controlling device installations are: steel bumper rail, $3.63 to $4.35/l.f.; bumper posts, $30.00 to $50.00/ea.; bumper/meter posts, $40.00 to $60.00/ea.; concrete curb, $3.00 to $3.60/l.f.; bituminous curb, $0.60 to $0.90/l.f.; concrete islands (2′-0″ wide), approximately $4.25/l.f.; concrete islands (3′-0″ wide), approximately $5.25/l.f.; and concrete islands (4′-0″ wide), approximately $7.00/l.f.

All parking lots operated by the Parking Authority are lighted at night. Depending upon the needs of the lot, economics, esthetics and other factors, either incandescent or mercury vapor lighting is used. In general, incandescent floodlights are mounted on wooden poles and provided with overhead service lines; while mercury vapor lights are mounted on aluminum poles and provided with underground service lines in pre-cast concrete conduits. All lights are operated by time-clocks, which turn the lights on and off automatically at pre-determined times.

Other items of work used in the construction of parking lots are chain link fencing, concrete bases for light poles, 3-in. concrete conduit, retaining walls, miscellaneous 1:2:3½ concrete, galvanized iron pipe handrail, topsoil, seeding and landscaping.

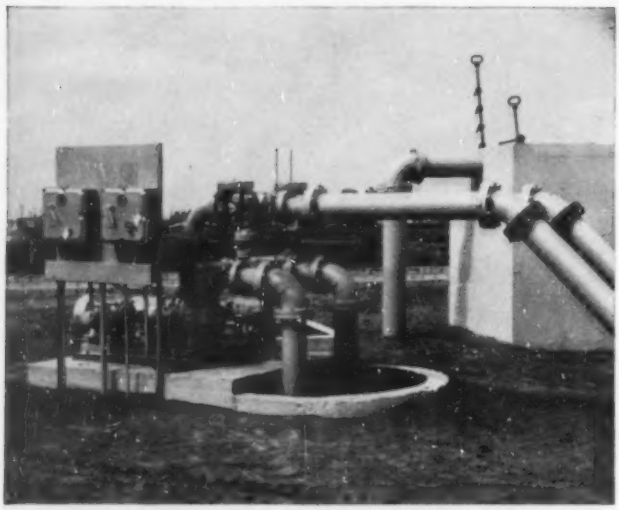
Recent bid prices for miscellaneous items of work are: Four-foot chain link fencing, $3.75 to $4.00/l.f.; seven-foot chain link fencing, $4.50 to $4.75/l.f.; stone masonry, $50.00 to $60.00/c.y.; brick masonry, $6.00 to $7.50/c.f.; concrete bases for light poles, $75.00 to $110.00/ea.; three-inch concrete conduit, $1.10 to $3.00/l.f.; miscellaneous 1:2:3½ concrete, $15.00 to $30.00/c.y.; galvanized iron pipe handrail, $6.00 to $7.00/l.f.; topsoil, $7.00 to $9.00/c.y.; and seeding and landscaping, $0.30 to $0.60/s.y.

The Parking Authority furnishes and installs all parking meters, coin changing machines and signs; and does all pavement painting. The contractor is responsible for the maintenance of all work for a period of six months from the date it is completed. Five percent of the final amount due for the work is withheld during this period. The contractor files a five-year pavement maintenance bond with the city for all pavement containing two inches or more of hot-mix bituminous surfacing material.

The average cost for developing five of the most recent parking lots is $340 per parking stall. This cost includes neither land costs nor meter costs.

Kenneth R. Miller is Chairman of the White Plains Parking Authority. Eric A. Andrews is Commissioner of Public Works.

HIGH and DRY...not way down in the pit...GORMAN-RUPP SEWAGE PUMPS



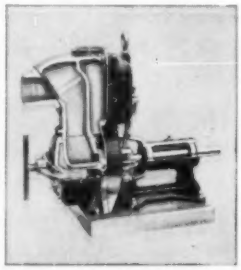
Twin installation of Model 14A2-B at a sewage treatment plant, Clair-Mel City, Tampa, Fla. Controls alternate pumps at regular intervals.

COST LESS TO BUY—Self-priming in lifts up to 15′, positive in action, nearly completely non-clogging. High and dry, their installed cost has allowed savings of as much as 50%.

COST LESS TO MAINTAIN—Almost no maintenance needed! No need to service by entering pit or raising pump. Just a turn of the wrist and the end plate is off.

PERFORM WHERE OTHERS FAIL—In lift stations and sewage plants, these Gorman-Rupp units have shown amazing records of savings . . . operating where others have failed. Let us show you examples.

2″, 3″, 4″ and 6″ pumps—connected to your power or ordered complete with power units. Write for complete specifications.



FAST-ACTION END PLATE—Exclusive end plate releases for access to impeller and wear plate. Two-vane open impeller specifically designed for handling spherical solids.

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Now better than ever...

Completely new from the ground up—backed by 10 years of rotary field experience—this all new Ingersoll-Rand Gyro-Flo 125 portable rotary compressor is based on results of extensive research, performance evaluation and customer suggestions.

Smaller and more compact than the original Gyro-Flo 125, this new unit incorporates many of the proven Gyro-Flo design features plus a host of new features that make it the best 125-cfm portable compressor available.

Some of its features are: larger engines at slower speed (1800-rpm)...60" track for greater stability on rough terrain...full-length tool boxes with more storage capacity...side covers that fold back safely away from operating eye-level...fuel and air tanks under lockable cover to guard against tampering...automatic drainage of oil from cylinders when unit is shut down...and provision for inspection of all rotor vanes. The new Gyro-Flo 125 is powered by 1800-rpm Continental engines—either gasoline or diesel. Ask your Ingersoll-Rand representative for complete details or send today for a copy of Form 2930.

DIMENSIONS AND WEIGHTS

2-WHEEL MOUNTING	GASOLINE	DIESEL
Weight (dry)	2442	2503
Weight (wet)	2647	2737
Length, incl. draw bar	10'1"	10'1"
Width	5'8¾"	5'8¾"
Height	5'1½"	5'1½"
Track	60"	60"
LESS RUNNING GEAR (INCL. SHIPPING SKID)		
Weight (dry)	2165	2226
Weight (wet)	2370	2450
Length	5'9¾"	5'9¾"
Width	2'8¼"	2'8¼"
Height	3'8¾"	3'9½"

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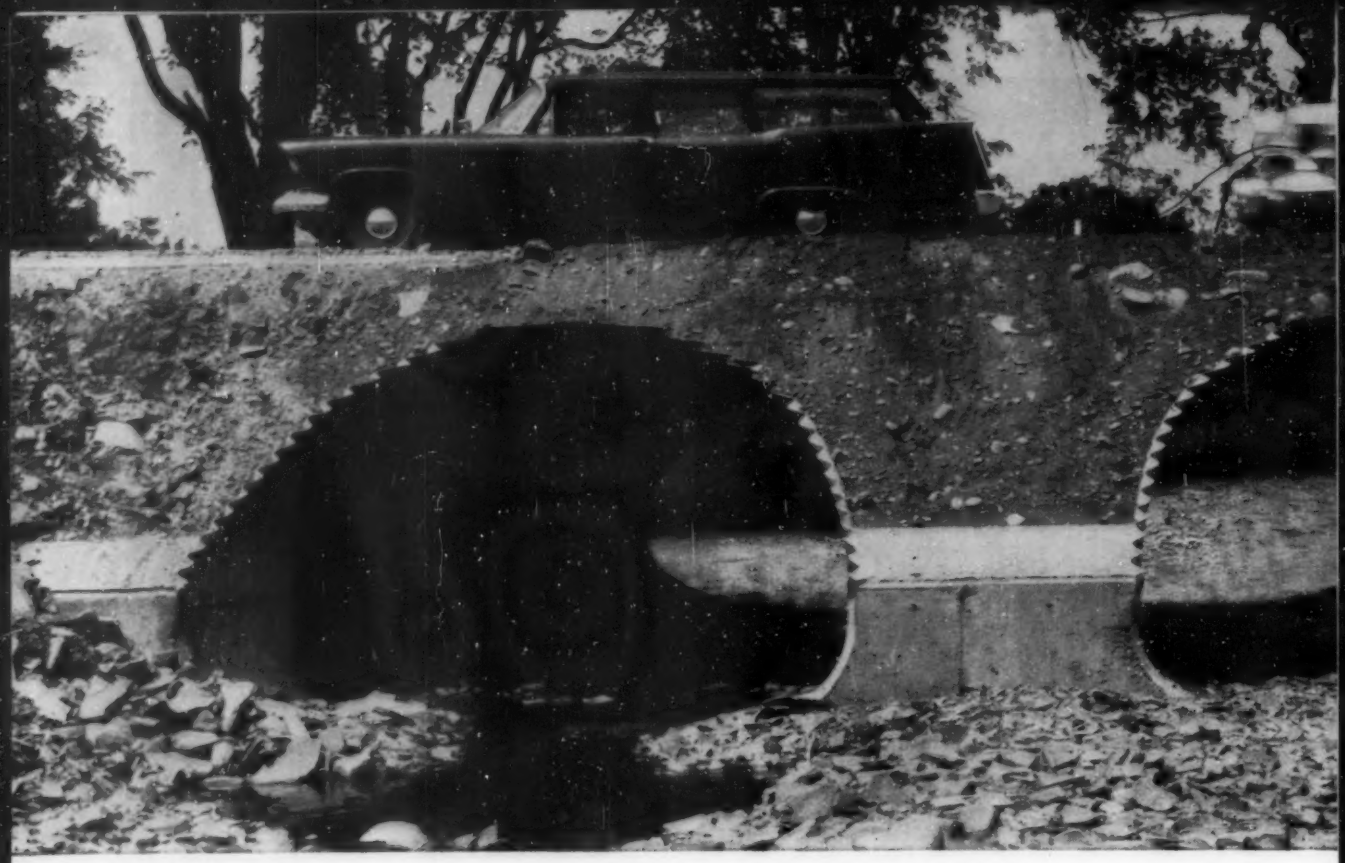
AN UNBEATABLE COMBINATION...GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS



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Let American Bridge help do

USS AmBridge Highway Beam Guardrail and Posts provide the surest traffic safeguard available. The rugged, flexible and highly visible steel beam guardrail is easily and firmly bolted to quickly driven steel posts. Available in 25' lengths to minimize splicing.

USS AmBridge Sectional Plate pipe, pipe-arches and arches eliminate the need for forms. And, being made of steel, there is no breakage. They are placed quickly, and can be extended whenever the road or fill is widened. They are extremely durable, and they can be relocated if necessary. AmBridge Sectional Plate comes in a complete range of standard sizes.

There's nothing easy about building a road, especially where there is an obstacle to span—or drainage to accommodate. Fortunately, however, you can throw these tough jobs to an outfit that specializes in handling them: American Bridge.

Wherever man or nature has created a space barrier, American Bridge can build a bridge of any length to span it—or we can re-floor an old bridge to support more weight . . . without stopping traffic. If the problem is a meandering creek, it can be funneled through an American Bridge drainage structure, which can be placed in days and will last for years. On the finished road itself, American Bridge can supply the strongest, simplest, *safest* guardrail on the market.

All AmBridge highway products are made from steel, and are manufactured to long-established, dependable standards. They can be placed quickly and simply—without kid-glove handling. Contact any office for information, or write to Pittsburgh for literature on sectional plate, bridge flooring or guardrail literature. *USS and I-Beam-Lok are registered trademarks*

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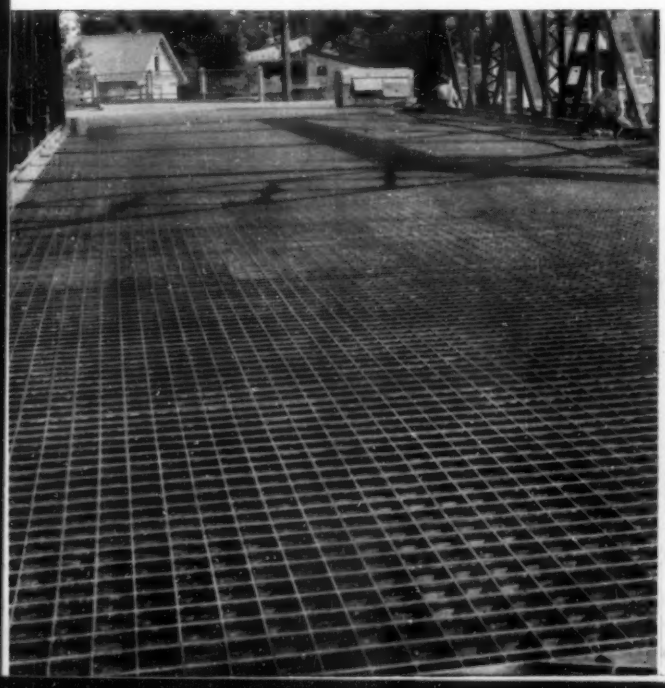
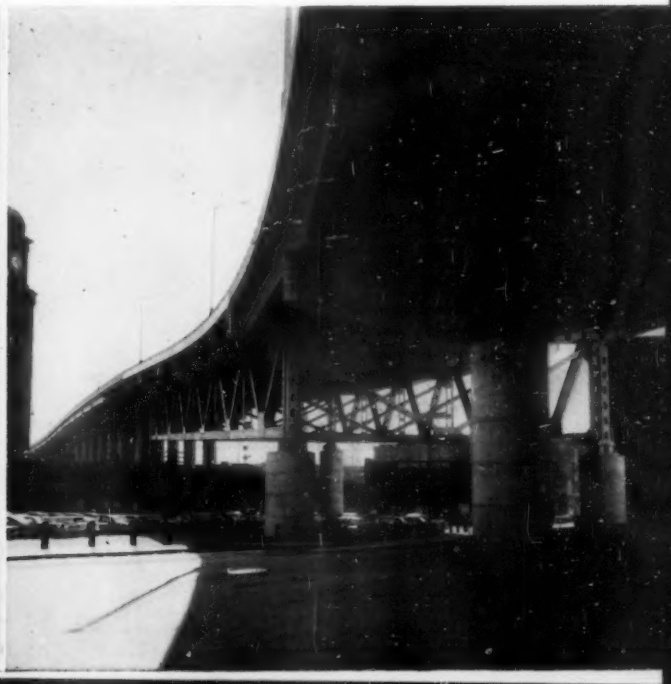
the toughest part of your roadwork

USS AmBridge I-Beam-Lok—the sturdy, lightweight, long-life bridge flooring for modern traffic—saves money on erection and maintenance. Ease and speed of installation minimizes traffic interruptions. Filled-type shown below, before pouring concrete, is available in units 6′ wide and up to 49′ long. They can be applied directly to stringers on spans from 6′ up to 8′ centers. Open type also available for spans up to 4′ long.

Steel is basic for bridges. And nobody knows more about building steel bridges than American Bridge; specialists in steel fabrication and construction since 1900. In nearly sixty years, we have handled every conceivable type of job. From big ones like the mighty Mackinac Bridge, and the new Carquinez span (the first major shop-welded bridge) to thousands of simpler and shorter structures.





THE HIGHWAY AND AIRPORT DIGEST

Prepared by **FRANK FORCE,** *Associate Editor*

Traffic Planning in Pittsburgh

Population trends, land use and construction of new roads are the important factors influencing traffic requirements and in Pittsburgh, Pa., a planning program is being followed. The Bureau of Traffic Planning receives $754,000 anually for the installation and maintenance of traffic signs, street name signs and street markings; for the maintenance of parking meters and traffic signals; for payment of electrical current; and for the traffic planning and administrative staff. An annual appropriation of $75,000 is allotted for new signals, signal improvements and overhead directional signs. Every effort is made to increase highway capacities by making effective use of street space and by utilizing traffic control devices in the most practical manner. Type of equipment used includes the following: Pedestrian control signals; temporary signals, signal-dial fixed-cycle controllers; multi-dial controllers equipped with time clocks; semi-actuated signals; radar detectors; volume-density type controllers; and a master controller which controls the downtown signal system.

"Pittsburgh's Approach to Traffic Planning." By Michael J. Gittens, Traffic Engineer, Pittsburgh, Pa. PUBLIC WORKS, August, 1959.

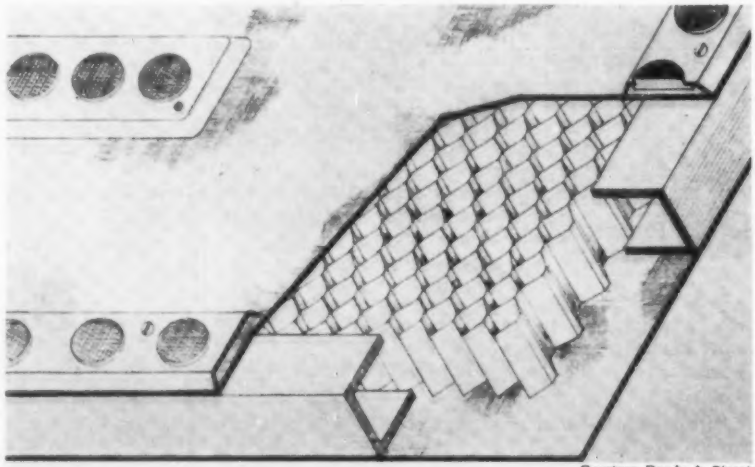
Better Signing Through Research

Visibility, placement, initial cost, replacement cycles and maintenance expenses are all factors city, county and state officials responsible for regulating road and highway construction must consider. Data developed by the Oregon State Highway Dept. in a legibility study made under controlled conditions for both day and night are as follows: That light letters on a dark non-reflectorized background are best for night visibility; that dark letters on a white background are best for day visibility; that for day visibility, superiority of dark letters on a white background as opposed to light letters on a dark background, is not marked; and that on the basis of superior night performance plus entirely acceptable day performance, these three types of signs are desirable: a) silver acrylic plastic PRA letters on an opaque dark green background; b) white letters with plastic buttons on an opaque dark green background; and c) wide angle silver reflective sheeting PRA letters on an opaque dark green background. Two considerations that should govern the selection of a specific sign are that it must be of a size and a design that will do an effective job of warning or directing at a particular location and second, it must be made to rigid quality standards from a material that will give economical service over a long period. Two new types of porcelain enamel signs have recently been introduced. One is an extruded aluminum porcelain enamel sign; the other aluminum honey-comb cored porcelain enamel. Both types are specially adapted to very large panels used as guide signs or interstate highways and major thoroughfares.

"Research Points Way to Better Signing." By Hugh Penton, Vice President, Highway Sign Div., California Metal Enameling Co. *Roads and Streets,* July, 1959.

Crown Vetch Stops Erosion

Beginning in 1948, seedings were made of penngift crown vetch, particularly in the western and northern parts of Pennsylvania where very difficult soil conditions existed. In 1951, these plantings were established in the Delaware River Valley district. It took 2 years to obtain a satisfactory stand of crown vetch. Now there is a plant that controls erosion, is attractive and relatively inexpensive to establish and maintain. Plantings of crown vetch from seed have been established at a cost of 7 to 10¢ psy. This cost includes the furnishing and placing of the following materials on typical slope areas (on



Courtesy Roads & Streets

● **CUTAWAY view of honeycomb core construction of porcelain enameled aluminum sign. The core is bonded to panels with adhesive and edges sealed against moisture.**

This Cat No. 12 Motor Grader is undercutting banks down 28 inches deep in St. Anthony Village, Minnesota. Cutting both sides, it averages about 8 blocks a 10-hour day in compacted hardpan. Owner: J. A. Denens & Son, Inc., Minneapolis, Minn.

LOOK! THESE IMPROVEMENTS IN THE No. 12 PAY OFF IN EVEN HIGHER PRODUCTION!

Increased throat clearance **New blade, lift and circle** **One-piece case for transmission and final drive** **New, two-tooth power control clutches** **New, positive mechanical lock**

SINCE it was introduced twenty-one years ago, the Caterpillar No. 12 Motor Grader has earned the title "standard of the industry." Constant improvements have kept it the undisputed leader in its class. Here are the latest improvements that enable you to get even more work at lower cost with less maintenance from this high-production machine:

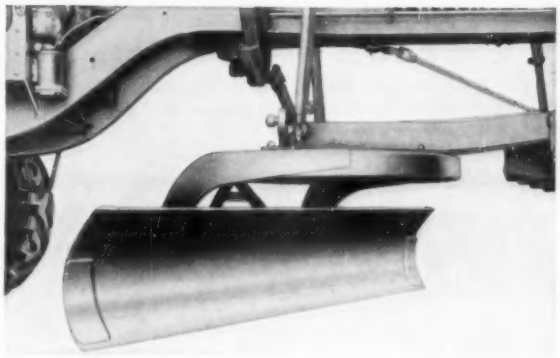
1 Clearance between the top edge of the blade and bottom edge of the circle has been increased to 5 INCHES. This provides improved rolling action, allows more material to move across the blade for greater production.

2 Blade thickness has been increased to 7/8 inch and blade beams have been increased in length and thickness to handle heavier loads. Lift arms have been lengthened and links shortened to enable operator to obtain all blade angles more easily. Circle reverse gear housing has been redesigned for better clearance as well as to increase the life of components and make service adjustments easier.

3 There's a new, stronger one-piece case for the transmission and final drive. This eliminates possible leakage at gaskets. In addition, transmission bearings have been strengthened for longer gear life.

4 New mechanical controls for reduced kickback, easier engagement. New power control clutches have two teeth, instead of four, and improved contact angles. They are more positive to engage, easier to hold in position.

5 New blade controls feature a positive mechanical lock—exclusive with Caterpillar. When the control is in neutral, the power shaft is locked by a set of gear teeth to prevent creeping.



See the improved No. 12 at your Caterpillar Dealer. Whatever the job, he has the right capacity machine for it. Ask him to show you *proof* that a Cat Motor Grader is your best investment. Ask for a demonstration, too!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

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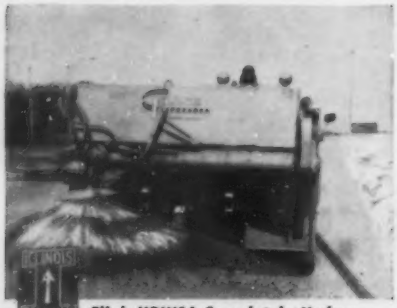
BEST BUY FOR YOUR TAX DOLLARS



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FLINK SPREADERS

When Specifications Require

- ONE MAN OPERATION
- LOW MAINTENANCE
- LOWER COST

Flink HDWS4 Completely Hydraulic Tailgate Spreader — A fleet of these efficient rigs help keep traffic rolling on the Illinois Tollway! Left-rear spinner permits easy 2-3 lane spreads in one pass; saves material. Hydraulically operated, Cab controlled, 2-speed auger permits instant change from abrasives to straight rock salt. Volume controlled by hydraulically operated feedgate.

Flink LMC Hopper Spreader — Handles salt, cinders and sand for heavy-duty ice control. Pea gravel and chips for seal coating. Choice of PTO, hydraulic or gasoline engine drive, Cab controlled. Uses the only power transmission of its kind in the field. No worm gears, no "out-of-straight" shafts of U-joints. Differential equalized drive.

Flink HD42 Hydraulic Drive Tailgate Spreader — Self-feeding. Handles sand, chips, cinders, calcium chloride, chat etc. Forward spread for ice control, reverses for seal coating. Spreads from width of truck to width of street, thick or thin. Replaces tailgate on present trucks. Trips for dumping just as original tail-gate did.

Flink Model SS Pull-Type Spreader —

Can't be beat for simple maintenance and operation. For low cost ice control, seal coating and dust control.

BAKER Flink SNOW PLOWS

FOR FAST, LOW COST SNOW REMOVAL!

Reversible or one-way plows for 1½ to 5 ton trucks and up. Sectional or one-piece, full length cutting edge trip. Exclusive blade-hinge weldments in place of hinges cut maintenance. Full 3¼" wear on a 6" cutting edge. Operating position adjustable 65° or 75° from horizontal.

For literature or name of nearest distributor, write:

THE Flink co. STREATOR, ILLINOIS

5513 North Vermillion Street

a 1,000-sq. yd. basis): 5 lb. penngift crown vetch seed (hulled, scarified, inoculated, and 70 percent germination); 5 lb. domestic ryegrass; 800 to 1,000 lb. agricultural ground limestone; 120 lb. commercial fertilizer (8-16-16 analysis); and 1,000 lb. hay mulch (timothy or timothy and clover mixed). Crown vetch plantings of 2-year field-run crowns have been established on the more difficult slope areas at a cost of 20 to 38¢ psy. This cost includes furnishing and planting one crown in a hole prepared by a dibble or planting bar. The flowers are rose, pink and white and bloom throughout much of the summer. It is drought tolerant and fire resistant and can be mowed to a minimum of 4 in. without jeopardizing the planting.

"An Engineering Tool-Crown Vetch." By Robert S. Ross, District Roadside Development Engineer, Pennsylvania Dept. of Highways. *Better Roads*, July, 1959.

Economic Impact of Road on Surrounding Area

Route 128 is a limited-access, divided four and six-lane circumferential highway extending about 60 miles around metropolitan Boston. Traffic volumes range from 40,000 to 50,000 vehicles per day, in the middle section of the road, and are less at the two ends. In 1957, contact was made with 99 plants and complete data obtained from 96. For analysis purposes, industries were divided into four groups: Distribution 21 percent, production 66 percent, research and development 9 percent and service 4 percent. The total investment in 96 plants was $85,000,000 and the total employment was 17,000, in 1957. New plants since then bring the investment to about $137,000,000 and potential employment to 27,500. Of the plants, 22 percent were either new companies or new branches and 78 percent were relocated from other areas. The relocated plants came predominantly from the in-town areas, 96 percent within a radius of 4½ miles of the city center and 68 percent within 2½ miles. The industrial development has brought new tax revenue to the towns along the route. The residential survey was undertaken to investigate the extent of residential activity along Route 128 and to isolate the effect of the expressway on residential development. Two general methods of approach were used in the study. In the first an adjacent band area about 1 mile wide and roughly centered on the highway was chosen

P&K street and highway LIGHTING STANDARDS

FOR EVERY JOB APPLICATION

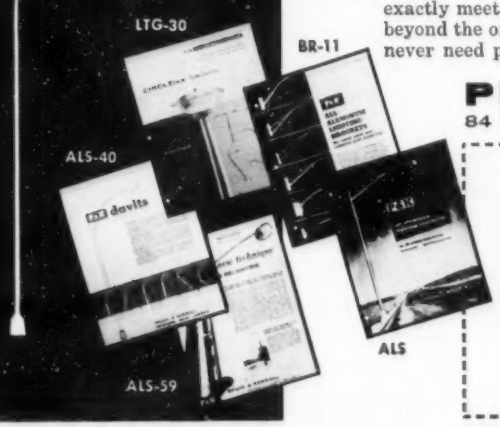
P & K all-aluminum standards are available in such a wide range of styles, sizes, and heights, that they offer virtually unlimited architectural design possibilities. They meet all requirements for strength and durability, and, most important, provide a basic beauty matched by no other material.

WITH UNIQUE ADVANTAGES

In addition to the strength, light weight and corrosion resistance inherent in aluminum, P & K has provided several exclusive features of its own: for instance, P & K's tapered elliptical one-piece arm design means a minimum inventory of parts, P & K features rivnut mounting to speed installation, P & K's one-piece base welded to the shaft means no expensive field assembly, and many more. The sum total add up to faster installation at lower cost.

MAKES LIGHTING DOLLARS GO FURTHER

With such a wide range of styles to choose from, backed by extensive production facilities, you can select standard units that will exactly meet your specifications. And for savings that go far beyond the original cost, consider this: P & K aluminum standards never need painting or other costly maintenance.



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There's a wealth of helpful information available. Use this convenient coupon.

☐ ALS—all-aluminum lighting standards ☐ LTG-30—describing CIRCLElux luminaires ☐ BR-11—all-aluminum lighting brackets for wood, steel or concrete pole mounting ☐ ALS-40—describing davit-style lighting standards ☐ ALS-59—describing aluminum conversion units

NAME.....

COMPANY.....

ADDRESS.....

CITY..... ZONE..... STATE.....

Payloads keep on the move with this Huber-Warco grader clearing the way.

Bruns uses H-W Graders

When Bruns Coal Company, a highway contractor of Zanesville, Ohio, got the contract for a six-mile section of the new Ohio Freeway, they put two of their Huber-Warco graders on the job.

The Bruns contract is for a portion of the new road that will link Cincinnati and Conneaut, Ohio. This highway has been designated as Ohio State Route 1, and will be a vital link in the nation's system of federal roads.

A total of two million yards of dirt will have to be moved on this project before the completion date of August, 1959. A Huber-Warco 5D-190 and a 4D-115 are constantly busy keeping the haul roads clear, and trucks on time.

One big cut in this section is 40 feet deep and 2,000 feet long. The largest fill is 70 feet deep and extends 1,000 feet on each side of a bridge over Conneaut Creek. Bruns will also handle two and one-quarter miles of ramps and interchanges.

A six-inch gravel base will be applied to help the drainage of water from under the road. The concrete pavement will be poured to a ten-inch depth. The dual lanes of this highway will be 24 feet wide, separated by a 54 foot median. Each lane will have five foot stabilized shoulders.

Bruns makes sure that their equipment is always in top shape to deliver the most work. To minimize downtime on the job, all equipment is serviced between the two 10-hour shifts. On this job they are working a six-day week.

Huber-Warco Company

MARION, OHIO

Huber-Warco on the job

"We own four Huber-Warco graders and know from experience that they are tough machines. We can depend on them for all types of grading work."

Lloyd Bruns, Vice President
Bruns Coal Company

on Ohio job

When asked for his comments on the Huber-Warco 5D-190, Edgar Matheney, the operator stated,"It's the best grader I've seen for haul roads. The torque converter and power-shift transmission really let the machine move dirt fast." He continued,"Its extra length and weight make it very good on bank sloping. It's sure dependable."

Why not investigate the merits of a Huber-Warco motor grader for your construction jobs. The BONUS features of Huber-Warco graders give you more machine for the money . . . . more work done faster . . . . and dependability.

Whatever the grading assignment, Huber-Warco motor graders work harder and faster.

Terms up to 36 months and rentals available . . . contact your Huber-Warco distributor.

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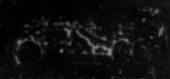
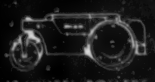
TANDEM ROLLERS


MOTOR GRADERS

MAINTAINER

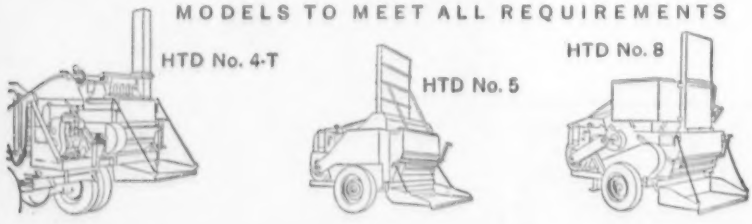

3 WHEEL ROLLERS

McConnaughay
HTD MIXER No. 10
½ TON PER BATCH

No Other Asphalt Mixers Can Do All These Things So Effectively

You can use a McConnaughay Mixer to reactivate and heat stock pile mixtures... prepare cold asphaltic mixtures... prepare hot asphaltic mixtures... dry various types of wet aggregates quickly, thoroughly... remove *both* moisture and solvents from bituminous mixtures... produce bituminous mixtures with tars, paving asphalts, cut-back asphalts, and emulsified asphalts. McConnaughay Mixers, operating under U. S. Patent No. 2,626,875, are authorized to mix emulsified asphalt and aggregates in the presence of flame and heated gases. Write for details and specifications.

MODELS TO MEET ALL REQUIREMENTS



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and compared with a control area. In the second method, access distance zones were set off at O-½, ½-1 and 1-1½ miles travel distance from the nearest interchange. In Lexington the real-estate tax per capita based on residential and commercial property has climbed from $39 in 1945 to $142 in 1958, an increase of 264 percent. In Needham, the corresponding figures are $48 to $127 for an increase of 165 percent.

"Study Traces Economic Impact of Road on Surrounding Area." *Better Roads*, June, 1959.

City Cuts Resurfacing Costs

A cheaper way to resurface oiled-gravel (asphalt - surface - treated) streets has been developed by Portland, Ore. The method uses the relatively new RS-K emulsified asphalt (cationic emulsion). In the 1958 season, RS-K was used for more than 80 percent of a program involving more than 1 million sq. yd. of seal-coat work. Cost for the entire program averaged out at 12¢ a sq. yd. Cationic emulsions may be made using a quarternary ammonium salt as an emulsifier, with the oil soluble part of the molecule being cation active. This produces droplets carrying a positive charge. These droplets are attracted by the negative charge found on most wet or siliceous rock. Main advantages of these emulsions are ability to coat wet aggregates and adhering qualities on siliceous gravels and sandstones. In this work a single surface treatment of about 0.2 gal. psy is applied. This is followed by about 25 lbs. of crushed river gravel psy in the ¼-in. to No. 10-mesh size range. The rock application must be made in from 20 secs. to 2 minutes after applying the emulsion. Rolling is undertaken some 20 minutes later, with two passes of a steel wheel roller needed. Street crews generally resurface three to four city blocks at a time, completing the work in less than an hour. Traffic is permitted on the street immediately. Officials estimate the effective life of such resurfaced streets at about five years. The cationic seal coat does not bleed and the spray can be closely controlled to prevent damage to automobiles.

"A City Cuts Resurfacing Costs." *Engineering News-Record*, July 2, 1959.

Overhead Signs For Traffic-Guidance

Along the 8-mile Newark Bay-Hudson County Extension of the New Jersey Turnpike, a motorist

Applying Columbia Calcium Chloride is the fast, low-cost way to build high surface density.

COLUMBIA CALCIUM CHLORIDE

helps your roads through late fall and winter

Within the next few weeks, your crews will have finished putting roads in shape to stand up under late fall and winter weather conditions: patrol blading, adding aggregate or binder soil where needed—and spreading Columbia Calcium Chloride.

The dense, compact surfaces resulting from Columbia Calcium Chloride resist rutting and pot-holing infinitely better than untreated roads. Motorists enjoy smoother, safer driving. Fewer bladings are necessary; new material requirements are cut. Maintenance costs show marked improvement right through the year. Helps you meet your road budget.

And, with winter's snow and ice just a few months away, you'll want to order Columbia Calcium Chloride right now for ice control and for treating abrasive stockpiles to prevent freezing. Check to make sure you have adequate stocks of Columbia Calcium Chloride on hand before the first snow flurries. If you're running low, just call our nearest District Office or write our Pittsburgh address to place your order.

Columbia Calcium Chloride mixed with abrasives or salt provides ice removal that's both fast and economical.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company · One Gateway Center, Pittsburgh 22, Pennsylvania

DISTRICT OFFICES: Cincinnati · Charlotte · Chicago · Cleveland · Boston · New York · St. Louis · Minneapolis · New Orleans · Dallas · Houston Pittsburgh · Philadelphia · San Francisco IN CANADA: Standard Chemical Limited

encounters three exits and seven potential choices of direction between the Holland Tunnel and the turnpike. One-half of the total roadway length is on elevated structures and the roadways are illuminated by mercury vapor luminaires for the entire length. In most locations the overhead signs are erected at separations where the appropriate destination information and large directional arrows suspended directly over each leg of the bifurcation clearly identify and delineate the turn-off from at least ¼-mile away. Usually the illuminated sign at the separation is preceded by a series of four advance warning signs of the roadside reflector type, located 2 miles, 1 mile, ½ mile and ¼ mile (at the beginning of the deceleration lane). Most overhead signs used by the turnpike authority are internally illuminated. The individual letters are cut out from the sheet-steel sign face and trans-illuminated by white translucent acrylic panels mounted behind the cut-out portions. This provides a well-lighted, evenly diffused sign copy, free of halation and glare, which the motorist can see and read from at least several hundred yards away, regardless of the direction and efficiency of his headlight beams. The sign bridges provide a 17-ft. clearance above the roadway. Usually two and in one instance three individual signs are mounted on a sign bridge and in some cases an additional sign may be cantilevered from the end of the bridge out over the opposite roadway. The signs vary in height from a minimum of 6 ft. to a maximum of 11 ft., and in length from 11 to 46 ft. with the dimensions tailored to the amount of message copy and the volume and speed of traffic past the point.

"Overhead Signs Solve Varied Traffic - Guidance Problems." By John R. Crosby, Assistant Traffic Engineer, New Jersey Turnpike Authority. *Better Roads*, June, 1959.

Cut Maintenance Costs With Cold Patching

Erie, Penna., has its own asphalt plant that can produce about 40 tons of material an hour. Late in the fall the plant turns out between 500 and 600 tons of asphalt paving mix which is put into storage for winter patching. The storage pile has more fuel oil in its mix than usual, so it won't dry out and harden too much. Besides cold patching, the material is used for patching utility cuts. Two formulas are used, as follows: One 2,000-lb. batch of slag mix consists of 1,540 lb. slag, 255 lb. sand, 40 gal. fuel oil, 135 lb. asphalt cement and 30 lb. lime; one 2,000-lb. batch of limestone mix contains 1,620 lb. stone, 225 lb. sand, 30 gal. fuel oil, 100 lb. asphalt cement and 25 lb. lime. The trucks are loaded the night before and garaged so the mix will loosen up. To apply the patch, first the hole is cleaned, dried out good with kerosene torches, filled and tamped. Larger holes are covered with dry sand. To speed the work, hoses up to 40 ft. in length are used from the tanks to the torches. This means less starting and stopping of the truck.

"Erie Cuts Maintenance Costs With Extensive Early Cold Patching." *Street Engrg.*, July, 1959.

Experience With Portable Traffic Signs

Portable traffic signs on pedestals are being used in Modesto, Calif., to replace signs that are knocked down during the night or on weekends. The assembly consists of a 24-in. diameter farm disc for the base and a 1½-in. diameter pipe coupling welded to the base to be used as a handle. A 1½-in. diameter steel pipe 4 ft. long screws into

YOU CAN BE PENNY-WISE AND SIGN-FOOLISH.....

Be cautious of signs that look like a good buy on the "flat" surface. Only embossed traffic-control signs and street-name assemblies by Miro-Flex have the durability to withstand the elements and abuse year after year. Miro-Flex signs are made on zinc-coated, Bonderized steel with baked-on enamel finish. Embossing gives them extra strength, rigidity, and legibility. A complete line of uniform signs conforming to Bureau of Public Roads standards and custom-designed signs are available. Send for free catalog and name of nearest source.

Embossed MIRO-FLEX SIGNS LAST and LAST...

THE MIRO-FLEX CO., INC.

1824 EAST SECOND WICHITA 7, KANSAS

Standard Traffic Signs Available for Immediate Delivery at Northeastern Warehouse

■ Koontz Equipment Corporation, 325 Ohio River Blvd., Emsworth, Pittsburgh 2, Pennsylvania ■

Protect against accidents like this!

Use straight Morton Rock Salt—the most effective way to help keep streets, freeways and tollroads safer in winter

Straight Morton Rock Salt does the job abrasives and Salt mixed with abrasives can't do to help prevent accidents caused by ice and snow. Morton Rock Salt gives *abrasive traction* against skidding even before the salt starts to melt the ice. Rock Salt crystals are larger than other commonly used ice melting chemicals and *penetrate ice deeper* with a corkscrew action—not just melt surface ice. Due to Rock Salt's better penetration, it reaches the pavement fast and quickly *melts* the bond between ice and the street surface.

Morton Rock Salt is safe, clean, economical

Straight Morton Rock Salt is non-toxic. It does not damage animals' paws, rubber, fabrics, leather, asphalt, brick or properly seasoned concrete. It will not clog sewers or leave a rutted, dirty pavement as will sand or cinders. What's more, Rock Salt melts *more ice at lower cost* at any temperature above 8° F. than any other commonly used ice melting chemical.

Send for more information today!

☐ Please send me your free book on ice and snow removal.

☐ I would like a Morton representative to advise me on how best to stockpile Morton Rock Salt.

Name_____

Title_____

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MORTON SALT COMPANY

INDUSTRIAL DIVISION

Dept. PW-9, 110 No. Wacker Drive, Chicago 6, Illinois

With safety flag flying, 3-wheel A-W roller "takes-off" as it resurfaces new jet runway at Philadelphia International Airport.

Austin-Western 3-wheel roller speeds resurfacing at Philadelphia Airport

The contract called for resurfacing 5800 ft. of runway, 150 ft. wide, at the Philadelphia International Airport. Contractor James J. Skelly, Media, Pa., chose an Austin-Western 3-wheel 10-14 ton roller to lay the required 1-in. wearing surface over a 2-in. base of bituminous concrete.

Well pleased with A-W

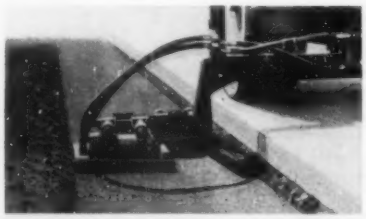
Mr. Skelly says, "I'm well pleased with the Austin-Western roller. It's more compact than most competitive rollers —easier to handle and gives the operator better visibility. Its V-8 engine delivers plenty of power, permitting the A-W roller to keep pace with the average daily output of 1600 tons of asphalt paving from two machines. There have been no maintenance problems. The A-W is an excellent roller—ideal for a progressive paving organization!"

Exclusive A-W features include hydraulic steering, full-width seats that let operators sit to right or left for better visibility; long-life oversize axles and antifriction bearings; many interchangeable parts; beveled outside roller edges that won't mark hot materials.

A-W 3-wheel rollers available in 8 to 11, 10 to 12, 12 to 14-ton models; tandems in 5 to 8, 8 to 12, 10 to 14-ton models. Portable tandem variable between 3½ to 6 tons. A-W vibratory Roller-Compactor unit fits any make 3-wheel roller; vibratory widener attachment also available.

A-W for profit

No matter what your compaction requirements, there's an Austin-Western roller to profitably meet your needs. Investigate! Consult your nearby Austin-Western distributor or write direct.



Vibratory widener attachment—for use with any 3-wheel roller equipped with A-W Roller-Compactor unit . . . may be mounted left or right.

Austin 100th YEAR Western

CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes

the coupling and a 1-in. diameter aluminum pipe 4 ft. long is bolted to the steel pipe and the sign is bolted to the aluminum pipe. The two pieces of pipe are joined by two ¼-in. x 2-in. bolts with wing nuts for speedy assembly. The bottom of the portable sign is at least 5 to 8 in. above the ground. Aluminum signs with Scotchlite sheeting are used to save weight and to minimize damage in transportation, erection and dismantling. Modesto has 3,627 traffic signs in place on its 133 miles of streets and in a six-month period 80 signs were knocked down.

"Modesto's Experience with Portable Traffic Signs." By Douglas J. Carmody, Director of Parking and Traffic, Modesto, Calif. *Street Engineering*, July 1959.

Snow Removal and Ice Control

Five articles on snow and ice control cover operation; equipment and personnel needed; abrasives, calcium chloride and salt used; public relations programs; two-way radio; and other data important to winter maintenance work. The articles are: "Snow and Ice Control Methods at the Township Level" by William A. Sommers, Bensalem Township Manager, Bucks County, Pa.; "Training and Organization Prepare for Rapid Change of Weather," By John F. Winter, Statistician, Dept. of Public Works, Portland, Ore.; "Light Snowfalls and Ice Cause Our Winter Problems," by North H. Newton, Champaign County Engineer, Urbana, Ohio; "Winter Operations on Connecticut Highways," by James W. Maher, Engr. of Roadway Maintenance, Connecticut State Highway Department; and "Express Toll Highway Needs Effective Snow and Ice Control Program," by W. B. Getchell, Jr., Executive Director, Maine Turnpike Authority. PUBLIC WORKS, August, 1959.

New Paving Policy

This is the first time Ahoskie, N. C., is using a plant-mix asphalt for the surface course and it is the first paving program where curbs and gutters are installed and the necessary drainage facilities are included. Two separate contracts cover actual construction. One covers curb and gutter work, drainage and base preparation. The other covers application of the surface course. Most of the streets have a minimum width of 31 ft. but the industrial streets and truck routes are 37 ft. wide. The base, a 6-in. sand, clay, gravel, is

CASE HISTORY

PROBLEM: In the Miami Area, large numbers of open bed trucks and trailers must be employed year round to dispose of heavy accumulations of palm fronds, brush and trimmings. How can the number of units be reduced? How can operating costs be lowered without hindering service?

SOLUTION: 32 cu. yd. PAK-MOR Handy Dumps and tractor-clam shell combination picks up denser, heavier loads in less time cutting man hours and operational costs.

CASE HISTORY

PROBLEM: In Beverly Hills, California, long costly hauls to dump (13 miles each way) reduced route pick-up time by hours. How could packer trucks increase route pick-up time without adding trucks?

SOLUTION: Establish centrally located transfer station. Packers transfer loads to 38 cu. yd. PAK-MOR trailers carrying 3 to 4 route truck loads to the dump each trip, giving route trucks more time to pick up.

PAK-MOR'S MULTI-PURPOSE REFUSE COLLECTION BODIES AND TRAILERS . . . DESIGNED TO SOLVE PROBLEMS AND SAVE MONEY!

SANITATION FOR THE NATION

PAK-MOR

MANUFACTURING COMPANY

LOOP 13 & ROOSEVELT AVE. POST OFFICE BOX 14147
WA 3-4317 SAN ANTONIO, TEXAS

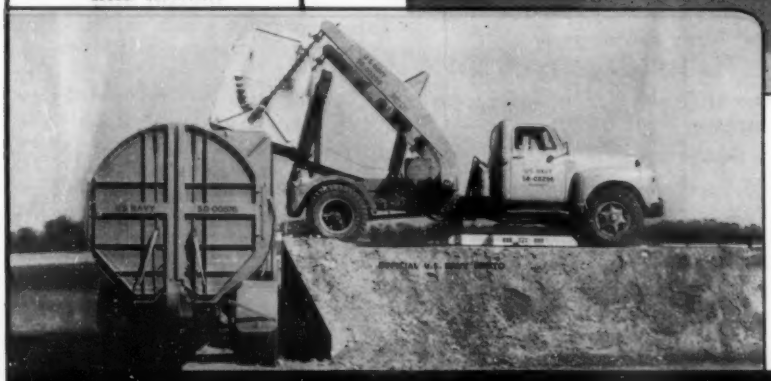
PAK-MOR's diversification can handle every refuse collection problem. Write for details and the name of your nearby distributor.

CASE HISTORY

PROBLEM: A contractor in Greenville, Pa. must increase number of pick-ups on both commercial and residential routes yet travel greater distance to a new dump without materially increasing costs?

SOLUTION: Large capacity PAK-MOR Lo Boye (28 cu. yd.) was put in service. It covers all routes, provides good manuverability, and reduces trips to the dump.

CASE HISTORY



PROBLEM: At a large Naval Air Station with container system, each container required individual haul to dump causing many trips each day. How can time and operational costs consumed on the dumping trips be lowered without reducing service?

SOLUTION: Large capacity PAK-MOR trailer loaded from a central ramp by hoist trucks, hauls in one load contents of many containers. Increases pick-up service while lowering operational costs!

SEE PAK-MOR'S BOOTH NUMBERS B-53, 54, 55 AND 56 AT SEATTLE A.P.W.A. 1959 CONVENTION

covered with 2 in. of hot plant-mix bituminous concrete. The town and the property owners share the cost. The latter pay the full cost of curb and gutter and one-third of the cost of the base and surface course. The town pays for the balance of the pavement, all drainage work and all work done in the intersections. The present program costs $230,000 and the necessary funds were obtained through a $210,000 general obligation bond issue sold at 3.73 percent interest rate. Property owners have the choice of paying their entire assessment within 30 days of notice at no interest or placing it on a 10-year program at 6 percent interest on the unpaid balance. Also a program is under way to clear intersections of large trees that block driver vision.

"A New Paving Policy." By J. E. Hulse, Jr., Town Manager Ahoskie, N. C. *The American City,* July, 1959.

Other Articles

"Dust Control." Special mixes **alleviate dust problems** on detours. California Highways and Public Works, May-June, 1959.

"America's First **Iron Bridges.**" By Richard Sanders Allen. Consulting Engineer, July, 1959.

"A New Method of Evaluating the **Strength of Road Stone.**" Particular reference to the weaker types used in road bases are covered. By F. A. Shergold, and J. R. Hosking, Road Research Laboratory, Department of Scientific and Industrial Research. Roads and Road Construction, June, 1959.

"Growing in Use: **Slag-Lime-Flyash** for Construction Base." Notes on a type of material finding growing utilization in and near various metropolitan areas. Low costs shown for typical projects for this blend, for which the Illinois Division of Highways has developed a specification. By C. R. Shupe. Roads and Streets, July, 1959.

"**New Voice System Alerts Drivers.**" In cases of emergency at night and when the driver's view of the sign is obstructed, an audible "Alert" signal or voice message coming into the vehicle, supplementing rather than replacing the road sign, would reduce if not altogether eliminate the hazard associated with missing a sign. By C. E. Quinn, Research Laboratories, General Motors Corp., Warren, Mich. Traffic Engineering, July, 1959.

"**Traffic Counting.**" Texas Highways, June, 1959.

"New Era Opens For **Roadside Parks.**" Survey by states of roadside rest areas and data on their part in the Interstate System. By Jack M. Werts, Formerly Director of Public Information, Kansas Highway Department. Public Works, August, 1959.

"**Fighting Snow and Sleet Storms.**" Establish objectives, ready the equipment and train personnel. Rural Roads, July-August, 1959.

"**Silicone Water Repellents** Protect Highway Concrete." By B. C. Carlson, Group Leader, Resin Section, Product Engineering Laboratories, Dow Corning Corp. Rural Roads. July-August. 1959.

"**Pavement Marking School.**" Metropolitan Washington Traffic Council sponsored school on the theory and practice of pavement marking, equipment maintenance and production techniques. Street Engineering, July, 1959.

• • •

Status of Fluoridation

By the end of 1958, 1,778 communities, supplied by 960 water systems, were applying controlled fluoridation to their drinking water. This represents a gain for the year of 4.2 percent in the population so protected.

During 1958, 145 communities with a total population of 1,449,155 adopted fluoridation. These places include Mobile, Ala.; Peoria, Ill.; Atlantic City, N. J.; and 142 smaller cities and towns scattered throughout the United States. During the year, two communities with 15,000 persons discontinued fluoridation, the smallest number to do so in any year since 1951.

The communities which adopted fluoridation during 1958 include 9 cities with populations of 25,000 to 250,000, 96 communities with popu-

HI-WAY Model E Spreader

Fast, one-man operation, fewer reloads, better traction, 4 to 40 ft. spreads of sand, salt or cinders!

3 Different Models Available: Truck mounted with PTO drive — easy to operate, economical to use. Truck mounted, engine powered (hydraulic drive available) — for more accurate, positive spreads. Dump body mounted, engine powered — use one of these lower cost rigs with several trucks, on or off truck in minutes. Capacities up to 8.8 cu. yds. mean fewer trips to the stockpile. Wide conveyor and steep 45° sides prevent bridging.

Other Model E Features

- 24" heavy duty conveyor
- 20" spinner with replaceable fins
- Removable inverted "V" over conveyor on 13 and 15' models
- Complete control from cab
- Accessory equipment for every need

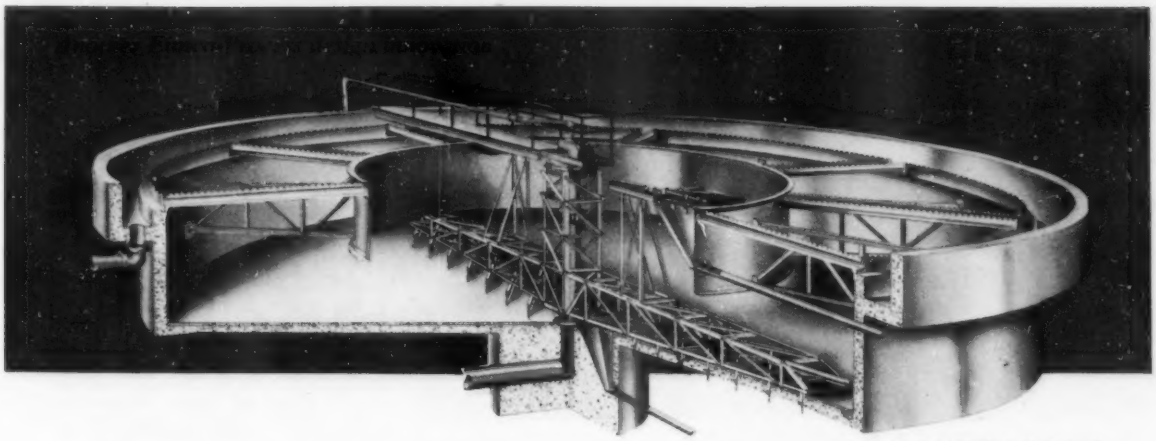
Write for the latest literature and complete specfications.

HIGHWAY EQUIPMENT COMPANY

619B "D" Ave. N. W. • Cedar Rapids, Iowa

HI-WAY S-P-R-E-A-D-E-R-S SALES & SERVICE

Hi-Way Spreaders . . . protecting today's motorist through better ice control.



Cutaway drawing of Type C Flotator-Clarifier, a center column supported unit suitable for tanks to 100 ft. diameter. Beam supported mechanisms are available for smaller tanks.

EIMCO-PROCESS FLOTATOR-CLARIFIER PROVIDES EXCELLENT REMOVALS ON WIDELY VARYING FLOWS

Specifically designed to handle waste flow surges yet operate efficiently during periods of low flow, the Flotator-Clarifier represents a new concept in clarification. Through a combination of dissolved air flotation and conventional sedimentation in a single tank, all types of solids—settleable, floating and those which tend to remain in suspension—are rapidly removed. Septicity and odor formation are minimized, and suspended solids, C.O.D. and B.O.D. removals equivalent to those of a conventional clarifier are obtained in about half the tank area.

The Flotator-Clarifier is available in a variety of types, sizes, modifications, and with complete or partial pressurization. It is ideally suited to primary clarification in sewage treatment; oil, grease and other suspended solids removal from trade wastes; and removal or recovery of finely divided solids and low specific gravity liquids from industrial process streams.

This Eimco-Process design innovation has been proved in a number of installations operating with excellent results. If you are concerned with the treatment of sewage or wastes with widely varying flows or composition, it will pay you to consider use of the Flotator-Clarifier. You will find no other equipment possesses its economy, flexibility and wide application.

Bulletin SM-1008 covers design features of the Flotator-Clarifier. Bulletin B-292 describes the Isleton installation, shown below, in more detail. Copies are yours on request.

THE EIMCO CORPORATION
Salt Lake City, Utah

PROCESS ENGINEERS, INC. *division*
420 Peninsular Avenue
San Mateo, Calif.

B - 419

. . . another outstanding installation

Partial feed pressurization and recirculation are features of this 32 ft. dia. Flotator-Clarifier at the Isleton, California, primary sewage treatment plant. The unit provides proper treatment of seasonal peak loads of cannery wastes, yet operates during periods of low flow without creating septic or malodorous conditions. Solano Engineers Associated, Vallejo, Calif., were the consulting engineers responsible for the design of this plant.

Fast, Low-Cost Ice Control

You eliminate treacherous ice from your streets and provide safe protection for your winter-time traffic **FASTER** and **CHEAPER** with straight de-icing salts. The TARCO "Scotchman" is **especially designed** for the correct application of these granular or pelleted materials.

This "Jeep" mounted "Scotchman" uses the **1 cu. yd. "Watchman" Hopper.** Here's enough salt to cover more than **5 miles of pavement, 30 feet wide.** One man operation. Gasoline engine driven or operated from P.T.O. The "Scotchman" spreader has been **job-tested over 10 years** by cities, state highway departments, and industrial plants.

For **emergency ice control** of busy intersections, hills and bridges this "Jeep" mounted "Watchman" Hopper and one man operated "Scotchman" spreader will save you a lot of time and material, and needless traffic tie-ups. See your nearest Tarco dealer . . . or write to us.

TARRANT MFG. COMPANY

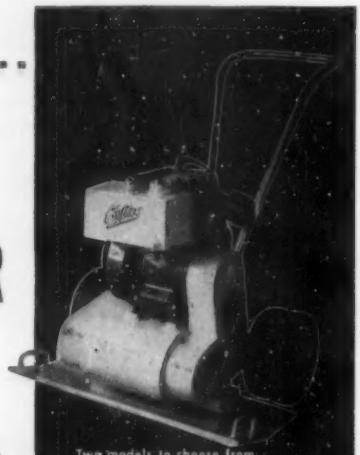
28 Jumel Place, Saratoga Springs, N.Y.

PACK, PACK, PACK . . .

with the Kelley

POWER TAMPER

Twenty-four hundred times a minute the Kelley 36KT Power Tamper hits with a force of tons, with the compacting force of a massive power roller. But Kelley Power Tampers are handier than rollers. They can pack earth backfill to maximum density next to foundations, piers, in pipeline trenches, on road jobs, etc. Also for finishing blacktop, with heater shoe attachment available.



Two models to choose from: Model 36KT (above) with 30" or 36" wide shoe, and Model 18KT with 18" or 24" wide shoe.

Below, Model 18KT packing down sub-base materials on a road-widening job.

Kelley **MACHINE DIVISION**
The Wiesner-Rapp Co., Inc.
285 Hinman Avenue
Buffalo 23, N. Y.

Please send us information on Kelley Tampers.

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lations of 2,500 to 25,000, and 46 towns with populations of less than 2,500.

It is estimated that approximately 118 million people are using water from community sources. Of this number 35,240,000, or about 30 percent, are drinking water with controlled fluoride concentrations which provide optimum protection for preventing dental caries. In addition, about 7 million people obtain drinking water from community sources which naturally contain the recommended fluoride concentrations.

Cost of Snow Removal and Sanding

The Maintenance Department of the State of Montana keeps 5771 miles of roads in repair and in traveling condition during the winter months. This work costs a great deal in upkeep of machinery, and for salaries of the men that work around the clock, sanding and plowing. The cost of snow removal amounted to $671,889 last winter, and sanding cost another $531,141; altogether a cost of $1,203,031, or an average of $208.46 per mile.

Automatic Toll Collecting

Public use of the 28 automatic toll collectors on the Garden State Parkway in N. J., increased considerably. They received $8,610,773 in toll payments as compared to $7,595,130 in 1957. The machines were in operation at 7 of the Parkway's 11 across-the-road toll plazas, serving only those motorists who had the exact change handy. These machines handle any deposit of coins totaling 25¢.

A total of 169 motorists was convicted of evading the payment of tolls in the automatic lanes. These motorists paid a total of $2,430 in fines and court costs in seeking to evade the payment of only $39.77 worth of tolls. Their cases were heard in local municipalities with the fines and costs being paid by the motorists to the State and the local municipalities.

Deaths in Highway Accidents

Nearly 1.33 million persons have lost their lives thus far in traffic accidents on the highways of the United States, and an estimated 4,000,000 have suffered permanent injuries. Property damage totals exceed $90 billion. These are the statistics cited by Charles W. Prisk, director of the Highway Safety Study of the Bureau of Public Roads.

Plowing an AIRPORT or PARKING LOT, CITY STREET or EXPRESSWAY . . .

Think of

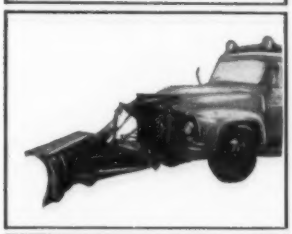
FRINK

—The Plow Designed to Meet YOUR Snow Removal Needs

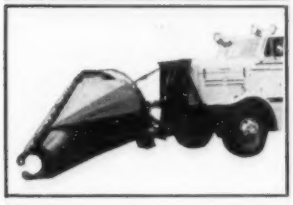
Whether snow removal problems in your area require a high-speed, heavy-duty V-type plow (**above**) or a lighter, maneuverable Reversible type, Frink has the plow specifically designed to do the job . . . faster, safer, at lower cost.

Frink, the pioneer in advanced snow-plow design, makes four basic types of plow, each with models to fit 1½ to 12 ton trucks . . . and most are interchangeable on same truck attachment. Get full details from your Frink distributor or write Frink for descriptive folders about any of these plows —

ONE-WAY Snow-Plow with Trip Blade
Finest speed plow made . . . tapered, curved moldboard throws and spreads snow to minimize deep banks, yet windrows neatly at city speed.



REVERSIBLE PLOW with Trip Blade
The all-purpose plow . . . throws right or left, or bulldozes straight ahead . . . cab lever sets position automatically, even while plowing.



ROLL OVER Plow with Taper Blade
Made only by Frink . . . can rotate to left or right position in 15 seconds . . . high-speed for deep snow . . . ideal for airports and dual highways . . . ends deadheading . . . easier to park.

V-TYPE Sno-Plow (shown at top)
Rugged powerhouse for heavy-duty plowing . . . self-ballasting to keep nose down, prevent side thrust . . . bevels side banks . . . will not wedge . . . safe at high speed . . . economical in use.

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Eastern Steel Products, Ltd., Preston, Ontario-Canada

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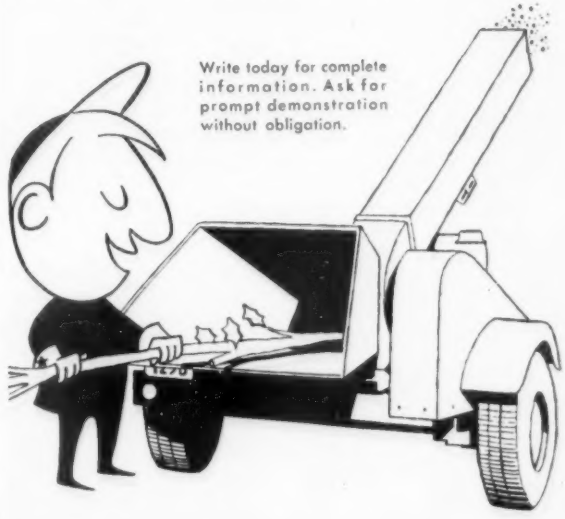

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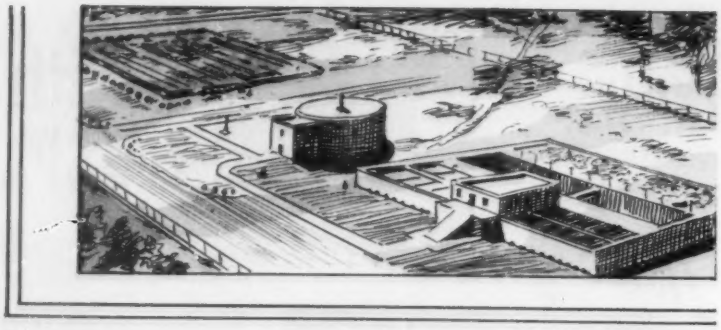


Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Radionuclides To The Rescue

Radionuclide tracers have been used by the sanitary engineering profession in recent years in solving problems which have defied precise analysis by other methods of measurement. Although their use is still far from routine, a sizable number of applications have been reported in measuring pipe flow, tank flow, coagulation and settling characteristics, corrosion and flow of sludge in digestion tanks. Radionuclides provide a highly sensitive technique for making these measurements although no single radionuclide has proved ideal for all purposes. The key factors used in the selection of the most effective tracers are as follows: 1) Half life of the radionuclide. 2) Suitability for measurement by laboratory or field equipment. 3) Safety of personnel. 4) Physical, chemical and biological compatibility with the fluid. Several examples of the use of radionuclides have been cited by the authors in sewage treatment, stream pollution studies and tracing the flow in streams and sewage lagoons.

"Tracers Solve Hydraulics Puzzles." By D. A. Pecsok, H. P. Kramer and D. W. Moeller. *Wastes Engineering*, July, 1959.

ABS Adsorption

For 15 months exploratory studies have been carried on to determine the fate of alkyl benzene sulfonate (ABS), the principal component of most synthetic detergents (syndets), in natural water systems and in early stages of domestic water treatment. The studies were principally concerned with the residue of ABS that passes through waste treatment or which reaches streams in untreated wastes. Usually heavy reliance is placed on the processes of natural self-purification of surface waters in developing domestic water supplies from surface sources. The very marked activity of ABS led to the examination of its adsorption from dilute water solutions on soil, silt and other fine suspended solids. The present studies are aimed at obtaining a clear comparison of the various natural adsorption systems including natural soil, stream silt, etc. In addition, it was felt that a more general approach could be made by observing the adsorption characteristics of ABS on two broad classes of surfaces; those that are readily wetted by water (hydrophilic) and those which are not readily wetted by water (hydrophobic) but which have an affinity for hydrocarbons. This preliminary study showed that materials that absorb the hydrocarbon branches of ABS are markedly more effective in taking ABS from water solution than those that attach to the water-seeking bond. Petroleum oil emulsions, powdered paraffin and activated carbon were used to represent the first class of adsorbents. China clay, talc, diatomite, silica gel and precipitated calcium carbonate were used to represent the second. Preliminary studies indicated that activated carbon treatment of waste-bearing waters is likely to be the method of choice for efficient removal of ABS should this step become necessary.

"Adsorption of ABS on Particulate Materials in Water." By C. E. Renn and M. F. Barada. *Sewage and Industrial Wastes*, July, 1959.

DO Analyzer

Scientists of the Robert A. Taft Sanitary Engineering Center first developed a prototype system for the continuous analysis of dissolved oxygen in water. Since the prototype indicated promise of successful application, a contract to engineer and build a functional field instrument was negotiated with the Hays Corporation in December, 1957. It consisted of a pump, a system for aspirating and separating the gas and water, and a standard commercial apparatus for analyzing gases for oxygen, modified to read in percent saturation. A schematic diagram and photographs describe details of the apparatus. The instrument performed reasonably well in laboratory and field tests and under a variety of water conditions and gave DO levels at an accuracy usually within ± 5 percent of saturation as compared with the Winkler test. As the result of the testing program, certain limitations or needs for improvement were noted. Future models will include design changes to overcome these limitations.

"Performance Test of Continuous Recording Dissolved Oxygen Analyzer." By M. O. Macklin, D. J. Baumgartner, and M. B. Ettinger. *Sewage and Industrial Wastes*, July, 1959.

$100 Million Sewer System

A $15 million sewer project is under way in Jacksonville, Florida, the initial phase of an overall, long-range program to cost ultimately about $100 million in accordance with a master plan prepared in 1955. The master plan did not call for a sewage treatment plant in the near future, but the State Department of Health would not approve sewer construction unless treatment was included. The treatment plant being built to handle the load for the present time will consist of aerated grit chambers, primary settling tanks and chlorination. Sludge will be digested and then dewatered on open sludge drying beds. After removal of all settleable solids, the chlorinated effluent will be discharged into the St. John River where the current is swift

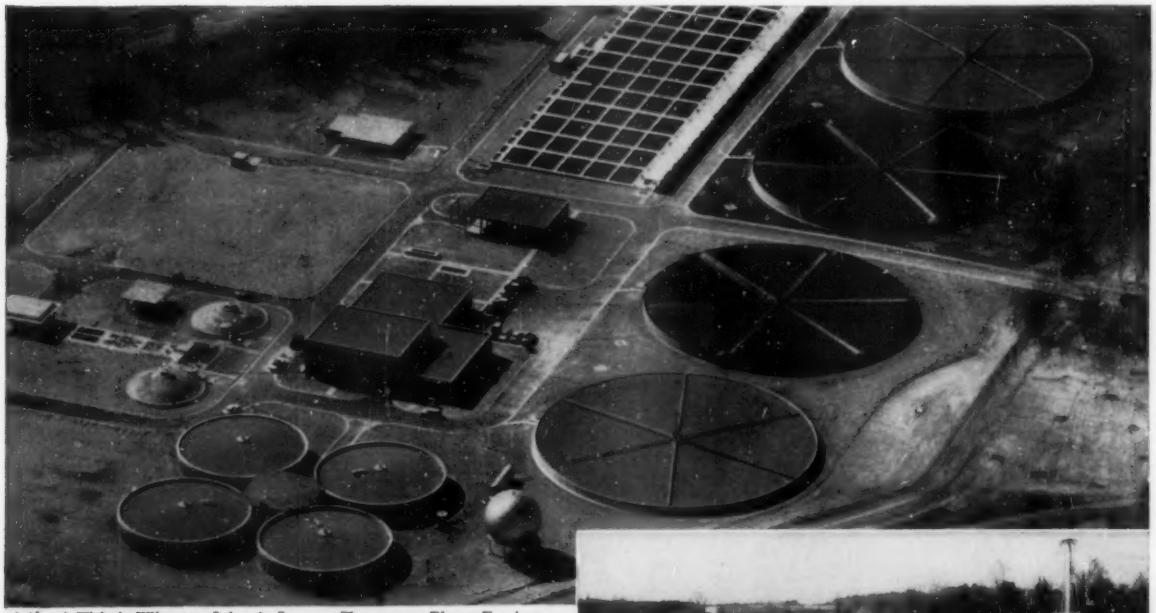
Winston-Salem is Big Business

When a city jumps from 13,600 to 93,000 in population in less than four decades—you have "bigness" in growth. When that same city becomes a leading industrial center and has an industrial waste almost equivalent to its expanded population—you have "bigness" all over again. Winston-Salem is that city!

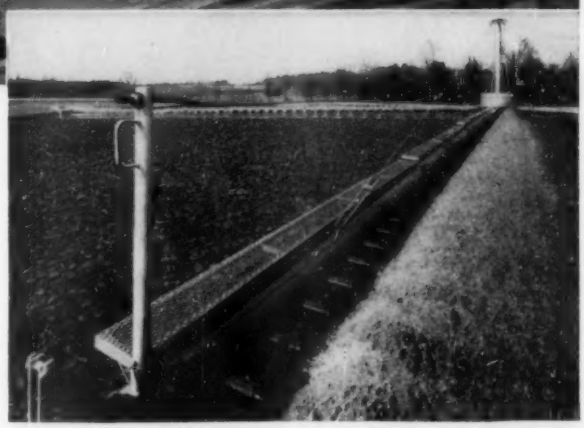
The four giant P.F.T. Rotary Distributors, 200′ in diameter, are characteristic of this tremendous growth. Equipped with specially designed P.F.T. Spreader Jets, for uniform distribution, these soundly engineered and ruggedly constructed distributors handle a flow of 25.0 mgd!

Other P.F.T. equipment in this modern sewage treatment plant, capable of handling a population equivalent of 200,000 and designed by Piatt and Davis of Durham, N.C., includes: Four 90′ Floating Covers, three complete Pearth Gas Recirculation Systems (the fourth digester is arranged for future Pearth which can be installed without interrupting digester operation), three P.F.T. #750 Heaters and Heat Exchangers that are gas and oil fired, Gas Safety Equipment, Supernatant Equipment and Floating Cover Gauge Boards with High and Low Level Alarms.

Crack engineering and construction teams, along with high quality P.F.T. sewage treatment equipment, gives progressive Winston-Salem truly a plant to be proud of.



(*Above*) This is Winston-Salem's Sewage Treatment Plant. Engineering skill and modern treatment equipment makes this plant one of the finest in the country



(*Right*) 3 tons of bronze forgings are incorporated in the four P.F.T. Rotary Distributors at Winston-Salem. The P.F.T. Spreader Jets are two-piece forged bronze units with removable deflectors.

P.F.T.

waste treatment equipment
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enough to effect rapid dilution as it sweeps toward the Atlantic Ocean, about 15 miles away. In the initial program, trunk sewer lines, with pipe diameters ranging from 18 to 84-in., will serve the present unsewered northwestern section of the city. The smaller diameters, 18 to 24-in., will be vitrified clay, and the larger diameters, 30 to 84-in., will be reinforced concrete lined with an interior coat of epoxy resin as a protection against hydrogen sulfide gas. Jacksonville civic interests have been fostering a plan to annex several outlying areas with a total population of 147,000 which would almost double the population of Jacksonville. If the proposal for annexation should be approved a second phase of the sewer program would probably have to be initiated within a year or two.

"Trunk Sewer Project Starts a $100 Million System." By C. E. Wright. PUBLIC WORKS, August, 1959.

Refuse Incineration

Recent nation-wide surveys show that in the larger cities the disposal of municipal refuse by incineration is displacing other methods of disposal. This is partially the result of the progressive depletion of suitable sanitary landfill sites and partly due to the recent accelerated improvements in design of incinerators which have produced increased efficiencies, reduced costs and enabled relatively nuisance-free operations. In this article the author presents a comprehensive discussion of the trends and developments which have occurred in the past decade. He concludes that competent designs should be based on a thorough engineering analysis and a design of each component part, including heat and mass balances for several critical sets of conditions. Empirical factors and values extrapolated from other operating plants are neither dependable nor economical and should not be used as a basis for the design of present-day incinerators.

"Refuse Incineration—Trends and Developments." By Casimir A. Rogus. *The American City*, July, 1959.

Sludge Collectors

The Joint Meeting, a regional sewerage organization serving 11 municipalities in Essex and Union Counties, N. J., placed the first pair of Mieder-type traveling-bridge sludge collectors in this country into operation in 1937. They have given outstanding performance with low maintenance and repair costs, coupled with significant operational advantages. So successful have they been that two new improved Mieder units have recently been installed for their sewage treatment plant located at Elizabeth, N. J. This plant provides primary treatment only, together with grit collection by means of a box rack and fine screens. Primary sedimentation in four large rectangular settling tanks provide a 2 to 3-hour detention period. The settled sludge is removed from the settling tanks by means of the new Mieder sludge-scraping machines which are the traveling-bridge type straddling the rectangular concrete tanks. The machines are four-wheel-drive, self-propelled carriages driven by a 7½-hp electric motor followed by a fluid coupling, electric solenoid brake, and a gear transmission box, with necessary sheaves and chains to drive the unit. The machine traverses from one end of the tank to the other on standard section rails laid alongside each tank. The scraping blade is continuous and can be raised or lowered for each operation of sludge scraping, skimming, or

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will protect your system best?

LINK-BELT builds 7 types, can recommend the most efficient for your needs

Modern sewage treatment requires grit removal to reduce maintenance costs on mechanical equipment and eliminate operational difficulties. Link-Belt has been manufacturing the finest in grit collection equipment for over 25 years—offers types and designs for any local conditions or requirements. For full details, contact your nearest Link-Belt office. Or write for your copy of Grit Collecting and Grit Washing Book 2571.

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SANITARY ENGINEERING EQUIPMENT

TYPE AB AERATED GRIT COLLECTORS are ideal for large installations, or at plants where it is desirable to combine pre-aeration and grit removal in the same tank. They consist of a Type B grit collector and porous tubes for admitting compressed air.

TYPE SW GRIT WASHER is a separate screw that washes and dewaters grit conveyed to it by pump, ejector, air lift or mechanical means. It can be counted on for long, dependable service in separating grit, water and putrescible matter.

STRAIGHTLINE GRIT COLLECTORS provide an easy method of collecting settled grit and inert solids without draining the grit chamber. These solids are dewatered and removed from the chamber by flight conveyors, screw conveyors, or buckets attached directly to the collectors. Shown is a Link-Belt Type B double-strand installation.

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World. 15,900

traversing. The bottom of the blade is fitted with a strip of pure gum rubber, ½-inch thick by 6 inches wide which acts like a windshield-wiper squeegee against the tank floor during the sludge scraping cycle. At the completion of the scraping cycle, the blade is elevated until only the lower edge is below the surface of the liquid and in such a position, the machine is reversed toward the effluent end of the tank, providing a skimming operation. The blade can be elevated completely out of the water for traversal in either direction.

"A Different Way to Collect Sludge." *The American City*, July, 1959.

Other Articles

"Water **Pollution Control.**" Water resource protection is supported by a number of developments in water pollution control. By Paul D. Haney. Water & Sewage Works, July, 1959.

"**Braced Cofferdam** Overcomes Tough Lift Station Foundation Problem." This cofferdam is different from others in that it is located midway on a steep bank of the Ohio River. By Earl Patton. Wastes Engineering, July, 1959.

"A **Review of the Literature** of 1958 on Sewage, Waste Treatment, and Water Pollution." This last of three sections of the Literature Review covers water pollution. By Research Committee, Federation of Sewage and Industrial Wastes Association, H. Heukelekian, Chairman. Sewage and Industrial Wastes, July, 1959.

"70 Miles of **Trunk Sewers** for County Sanitation Districts." One of the largest sewer projects ever undertaken in this country was started in Orange County, California, this past year. By Lee M. Nelson. Public Works, August, 1959.

"Metabolic Energy Balances in a Total Oxidation **Activated Sludge** System." Evaluation of the results from the continuous operation of this type of unit. By R. Rupert Kountz and Charles Forney, Jr., Sewage and Industrial Wastes, July, 1959.

"Television for **Sewer Inspection.**" In Cincinnati closed circuit television is used for the inspection of regulators, interceptors, manholes, chambers, tunnels and equipment in confined and inaccessible places within the sewerage system. By Arthur D. Caster. Sewage and Industrial Wastes, July, 1959.

• • •

Refuse Incineration

(*Continued from page* 125)

cally as a unit. Raising these groups of grates alternately raises and moves the refuse forward in the furnace chamber. At the front wall of the chamber the ash is dumped into ash hoppers by means of hydraulically operated dumping grates.

In Connecticut hydraulic-operated grates have been free of any serious mechanical difficulties. Hand stoking is practically eliminated except at the dumping grates. Clinker is reduced. The installations in Connecticut have operated in a narrow temperature range between 1600 and 1800°F. This is possible because charges of refuse are frequent and there is no "burning-down" period required for an ash dump. As a result the burning rate in tons per hour has increased and periods of stack smoking decreased. Maintenance on the refractory brick lining is reduced because of less "thermal shock" from temperature variations.

The latest thinking with moving-grate ignition chambers is the possibility of omitting the combustion chambers which generally follow. If the ignition chambers were roughly doubled in volume over that usually provided, the over-all burning efficiency should be the same at reduced cost. Although this proposal is relatively new, operating results should be carefully watched.

It's setting new
Sewer Cleaning Records
from coast-to-coast!

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Others Pending

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- No Shoveling from Street to Truck!
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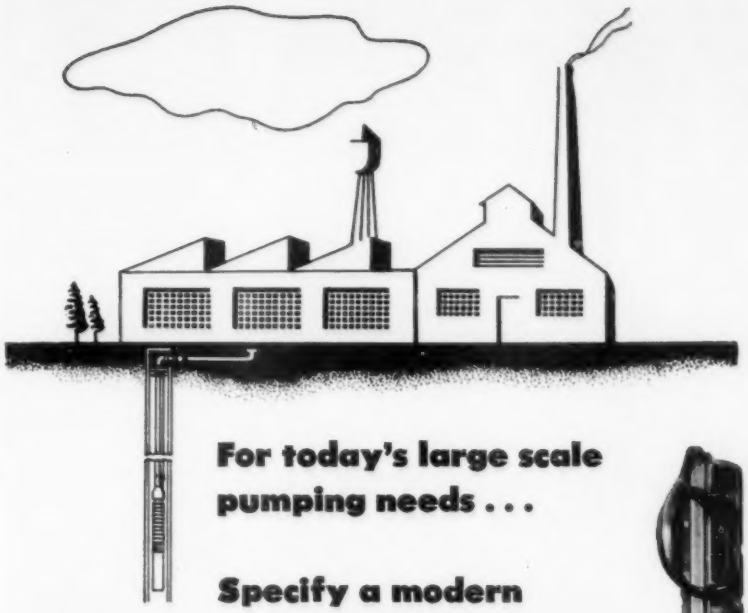
415 SOUTH ZANGS BLVD., DALLAS, TEXAS

Fly Ash Removal. Gravity deposition of fly ash in the expansion chambers and flues of incinerators is a misnomer. Actually the ash is thrown to dead pockets in the passages by changes in gas travel direction and the action of checker walls or baffles. When these pockets are filled, the fly ash escapes through the chimney. Less fly ash escapes when forced draft under the burning grates is avoided. Fortunately forced draft is required very infrequently today because of the higher percentage of rubbish in refuse.

In order to meet present air pollution ordinances or those which will surely come in the future, something more than baffles is needed to prevent excessive fly ash discharges. The most promising and economical method of those currently existing for fly ash control is the use of single or multiple water-spray baffles in the expansion chamber. The expansion chamber floor is sloped and equipped with additional water jets or nozzles to discharge the fly ash slurry to a small lagoon or settling pond by either gravity or pumping. Water pockets in the chamber floor also aid in the removal of fly ash. When water conservation is necessary, the effluent from the lagoon can be recirculated. Many designs are possible including the use of conventional mechanically-cleaned settling tanks for slurry treatment. When an incinerator is located near a sewage treatment plant, the plant effluent may be used as a source of water, or a pond or stream may be utilized. Low water pressure is used for the curtain water sprays and about 60 psi for the floor jets. Conventional centrifugal pumps with modifications are suitable for pumping the ash slurry when gravity flow cannot be obtained.

Ash Handling. Manual handling of ashes by hand stoking into small ash buggies is practically a thing of the past. Manual handling is laborious, causes fly ash nuisance and is time consuming. Gravity discharge of ashes through dumping grates to ash hoppers, equipped with water sprays for thorough quenching, is common practice.

From the ash hoppers the quenched ashes may be dumped directly into truck bodies, or additional ash storage may be provided by dumping the ashes into large movable buckets standing on the ash receiving floor. This latter scheme is becoming increasingly popular as a means of reducing the size of the fixed ash hopper



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Proved and tested by almost half a century of service in installations all over the world, Sumo Submersibles will give years of troublefree, maintenance-free service. Capacities range up to 2000 gpm. Power ratings range from 1/3 hp to 120 hp.

What's more, installation is exceedingly simple. The unit is simply attached to the end of the discharge pipe and lowered into the well casing. There are no drive shafts or bearings or alignment problems to give trouble. And, because the pump is coupled directly to the motor, more efficient use of power is obtained.

Sumo offers technical advice and assistance in selecting and applying submersible pumps to your needs. There's no obligation.

BULLETIN B-1000

has full information on Sumo high-capacity pumps. Call or write for your copy. Also request data on Sumo extra high capacity 120 hp units.

SUMO SUBMERSIBLE DRAINER PUMPS

for pumping water containing high percentages of solids. Write BULLETIN B-1100 for details on these rugged, heavy duty pumps designed for drainage, flooding or general service pumping.

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The Complete Line from 1/3 hp to 120 hp

space, yet providing the needed ash storage facilities for increasing volumes of refuse. Dempster-Dumpster containers, holding around 8 to 10 cu. yds., are often used. These containers are on wheels for rolling into position under the ash hoppers, and they can be lifted on to a special truck body for hauling their contents to the dump. Operating experience indicates that they are highly desirable, not only for the increased ash storage capacity provided, but also because of reduced maintenance on motor trucks. Direct discharge of wet ashes to trucks is hard on truck bodies and motor equipment.

In lieu of ash hoppers, water-submerged mechanical conveyors for ash are also used today with delivery of the ash to elevated storage bins for discharge to trucks. Ashes are also being quenched and conveyed by hydro-jets through tunnels to a central ash pit, and removed by buckets or other mechanical equipment to trucks. These modern designs for ash removal speed up the operation.

Induced Draft for Chimneys. At some plants, high expensive chimneys to disperse the gases of combustion and to provide a natural pull or draft for furnace operation are being replaced with relatively short stacks. Draft is provided with these low stacks by using induced draft fans. Such a design is practical and nuisance free when the gases of combustion are cooled and fly ash removed by adequate water sprays in an expansion chamber ahead of the stacks.

Improvements in Safety. Many old plants were unsafe plants, and some serious accidents, including loss of life, have occurred. The improvements in safety design of incinerators are many; the following comments outline the progress made:

1) Brick and concrete are the building materials of choice for fire protection with automatic or manual sprinkler systems available for storage pits and charging floors. Fire hose stations are being installed more at strategic locations.

2) More space is being provided on stoking floors to avoid crowded conditions.

3) Lighting is more ample, using large windows and artificial lights of adequate wattage.

4) Lunch rooms, locker rooms and showers are providing sanitary conditions for employees.

5) Drinking fountains with salt tablet dispensers are reducing cases of heat exhaustion during warm weather.

6) Better pitching of floors with adequate drains are aiding in cleanliness and preventing falls.

7) Building ventilation has been improved. In this connection the use of outdoor suction intakes for forced-draft fans is avoiding the possibility of creating a vacuum on stoking floors. A vacuum on stoking floors can cause blow-outs of flame through the stoking doors of ignition chambers with serious hazard to employees.

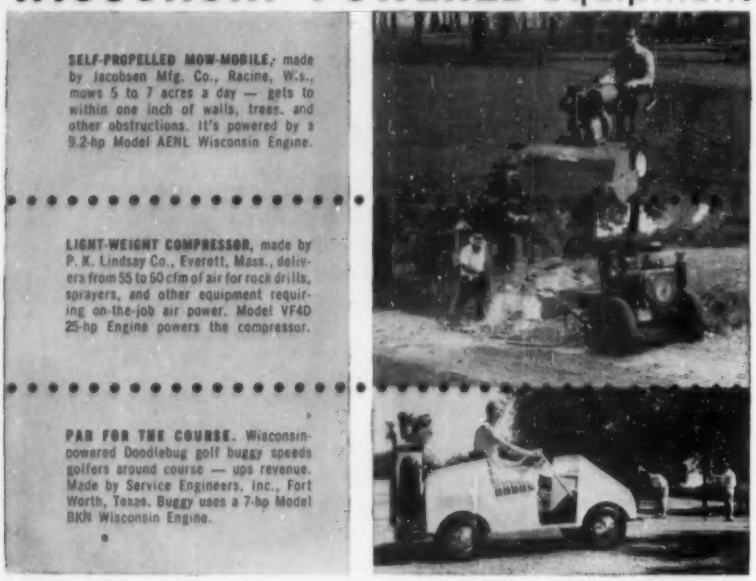
8) Chimneys are being equipped with aeroplane lights, lightning rods and safety ladders as standard equipment.

9) Two-way radio systems for signaling between the charging and stoking floors are supplementing other signaling devices and avoiding confusion and mistakes in directions. For safe operation it is important that the charging doors be closed when stoking.

10) Refuse storage pits are being built with access ladders, and either forced fresh air inlets or mechanical exhaust systems are

Speed turf and grounds upkeep with

WISCONSIN-POWERED equipment



SELF-PROPELLED MOW-MOBILE, made by Jacobsen Mfg. Co., Racine, Wis., mows 5 to 7 acres a day — gets to within one inch of walls, trees, and other obstructions. It's powered by a 9.2-hp Model AENL Wisconsin Engine.

LIGHT-WEIGHT COMPRESSOR, made by P. K. Lindsay Co., Everett, Mass., delivers from 55 to 60 cfm of air for rock drills, sprayers, and other equipment requiring on-the-job air power. Model VF4D 25-hp Engine powers the compressor.

PAR FOR THE COURSE. Wisconsin-powered Doodlebug golf buggy speeds golfers around course — ups revenue. Made by Service Engineers, Inc., Fort Worth, Texas. Buggy uses a 7-hp Model BKN Wisconsin Engine.

You cut work hours and save manpower by using Wisconsin-powered equipment for maintaining turf and grounds. You get the work done faster, and at lower cost.

Wisconsin air-cooled engines start fast and work steadily under all conditions. High-torque prevents slow-downs and stalling when the going gets rough — keeps men and machines working.

Quality features improve engine efficiency and performance — extend service life. Heavy-duty construction cuts wear on parts. The results: fewer repairs and replacements — less downtime.

Specify Wisconsin-powered equipment to up-grade your turf and grounds maintenance and down-grade your operating and maintenance costs. Write for Bulletin S-237

While attending the 1959 Public Works Congress and Equipment Show in Seattle, Sept. 20-23, visit the Wisconsin Engine Exhibit, Booth C-37, and discuss your power equipment problems with our representatives.

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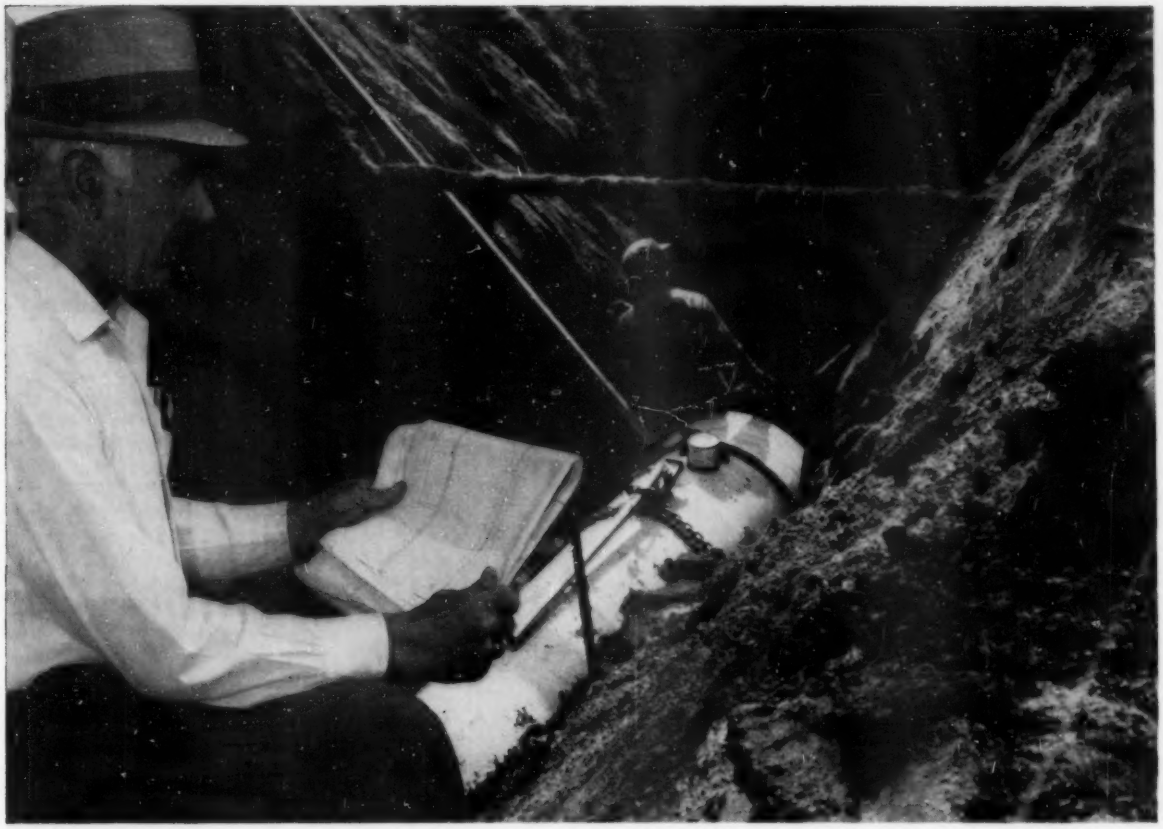

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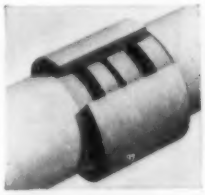
says Anthony Garcia, President
Allerton Construction Co., New York

"In my eighteen years of installing Transite sewer mains and house laterals, I have never had a 'comeback' because of line failures. Most of the installations have been 100% under water. Therefore, tight joints that stay tight are absolutely essential! For these reasons Transite has always been my choice for sewer line service. I never worry about passing leakage or infiltration tests. I play it safe —with Transite."



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Contractors that use them....recommend them!

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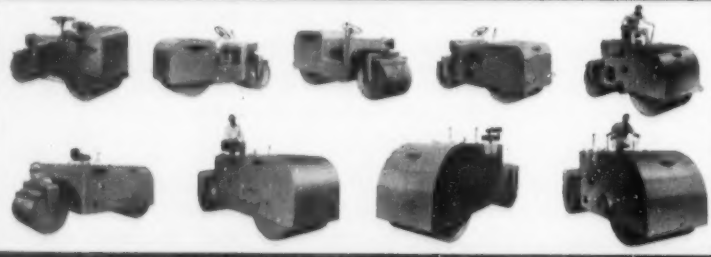

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used with air ports located near the bottom of the pits. Oxygen deficiency has occurred in the past when decomposing garbage has depleted the oxygen necessary for life when men enter such pits. Pit drains are also standard practice to permit hosing of pits for thorough cleaning. This avoids nuisance and frees the pits of vermin, mice and rats.

11) Elevators are commonly installed to carry heavy equipment from one floor to another and for employee convenience.

12) Some plants are equipped with a stationary vacuum pump having port outlets at convenient locations for suction cleaning of floors, stairs and flues.

Operation Practices

In the field of operation, better training of supervisors in safety has resulted in safer operation. The following items are indicative of present practices:

1) Truck stops at the tipping edge of refuse storage pits are kept in good repair, and employees or others are prohibited from standing on them when trucks are unloading.

2) When refuse pits containing decomposing refuse must be entered by employees, mechanical ventilation is used. Portable air blowers are used when provisions for mechanical ventilation have not been made in the design. (Safety belts should be worn also when persons are descending long ladders).

3) With floor-charge furnaces, the men charging the furnaces are protected with safety belts or guards are placed around the charging openings.

4) An alarm is used in the crane housing of bucket-charged furnaces to warn employees, as necessary, of descending loads of refuse.

5) Stokers are wearing protective clothing, including safety shoes, heavy gloves and goggles or face shields.

6) Men are not permitted to enter flues for removing fly ash until the temperature is below 100°F. and respirators are worn, if required for comfort.

7) First-aid kits are available and emergency instructions are posted for employee information.

8) And lastly, better housekeeping is the vogue.

Such safety measures reduce accident potential and improve operating efficiency. Coupled with recent design improvements, they make the modern incinerator vastly superior to those built years ago.

NOW...

a sewage plant priced to fit fringe communities

Public works officials all over the country are finding a new, low-cost solution to fringe-area sewage problems. This solution does *not* involve septic tanks or sewage lagoons . . . nor does it require floating a multi-million-dollar bond issue.

The solution is "Suburbia," a new sewage plant which brings simplified treatment within reach of even the smaller communities or sub-divisions . . . at a cost far less than elaborate sewage facilities. Each installation is individually tailored to the treatment requirements.

"Suburbia" systems can handle populations of from 200 to more than 2,000 – and can be installed anywhere in 90 days or less. The plant itself consists of an Imhoff tank (combining primary sedimentation and sludge digestion), a trickling filter, and a final sedimentation tank.

The only moving parts are a free-swinging rotary distributor and a small humus pump. "Suburbia" is simple, efficient, foolproof . . . with units designed and installed under the direction of your Consulting Engineer to assure State and Local Health Department approval.

"Suburbia" is furnished and installed, on a turn-key basis only, by . . .

HERE'S HOW "SUBURBIA" CAN SOLVE SEWAGE PROBLEMS FOR "EXPLODING" METROPOLITAN AREAS

Visualize a typical metropolitan area in the throes of a population "explosion." Fringe communities, with barely adequate sewage facilities, find it impossible to cope with the number of new homes erected. Intermediate rural areas become the target of construction – and are soon in trouble with septic tank effluents, raw sewage discharges, political boundary problems . . . and very little cash.

But then, foresighted public works officials and engineers divide this metropolitan area into natural drainage basins, with a "Suburbia" plant located at the receiving end. These are stage construction plants, sufficiently large to handle immediate needs, but built to expand to several times their initial capacities.

The necessary collection system and intercepting sewers for these plants are of size and location calculated to fit into a "master plan" for the entire metropolitan area . . . against the day when all may be integrated into a single, area-wide sewage disposal system.

Meanwhile, taxpaying citizens are drawn into the area . . . broadening the tax base until a bond issue can make possible a major, area-wide sewage treatment plant. The smaller "Suburbia" plants are then disconnected, moved to the receiving end of other needy drainage basins and re-erected with virtually complete salvage of components.

This, then, is how a typical metropolitan area can be "saved" by public works officials on the job. But . . . there is no need for such trouble to develop in *your* area . . . if you'll take the time to investigate this plan and the low-cost "Suburbia" sewage treatment plant which makes it feasible.

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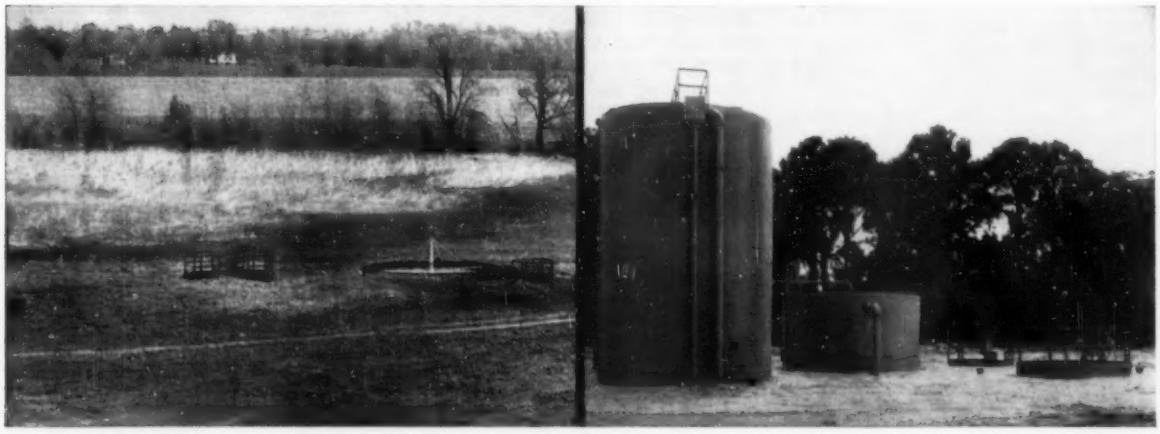
Installation below-ground in northern states, above-ground in warmer climates.



THE INDUSTRIAL WASTE DIGEST

Prepared by **CLAYTON H. BILLINGS,** *Associate Editor*

Continuous Analysis of Atmospheric Fluorides

Atmospheric fluoride pollution has been studied in recent years but without adequate methods for continuous sampling and recording of fluoride levels. An instrument has been developed which uses a flow colorimeter capable of driving a recorder and which can determine the concentration of any soluble ion-producing pollutant subject to colorimetric analysis. As a fluoride analyzer it photometrically measures and records the rate of reaction of zirconium-Eriochrome Cyanine-R reagent with soluble fluorides in a sampled air stream. A time stamp may be substituted for the continuous recorder to produce a dosimeter-type record if desired. The fluoride sensitive reagent is continually brought into contact with freshly sampled air. Fresh reagent is programmed into the system, and the schedule is subject to variation automatically, if the accumulated fluoride concentration exceeds a predetermined level. Comparisons were made between the accuracy of the automatic instrument and that of manual methods, and no statistically significant differences were detected. Continuous concentrations of sulfur dioxide at 0.5 ppm and a phosphorus pentoxide to fluorine ratio of 7 to 1 were tolerated by the reagent.

"Automatic Atmospheric Fluoride Pollutant Analyzer." By Donald F. Adams and Robert K. Koppe. *Analytical Chemistry*, July, 1959.

Multiple Stage Treatment For Refinery Wastes

A highly variable waste flow from the Cities Service Oil Co. refinery at Bronte, Ontario is subject to multiple stage treatment involving most known physical, chemical and biological methods. Equalization of flow occurs after oil separation, and neutralization precedes a chemical precipitation process carried out at a 95°F temperature using ferric sulfate. Air is introduced in the clarification basin to bring about flotation of non-settling material. This is followed by activated sludge treatment. Dowpac media are used in two trickling filters, next in line. After settling, the effluent is discharged to a holding basin for sampling and quality control and is then subjected to ozonation for complete oxidation of phenols. Addition of activated carbon and passing the liquid wastes through rapid sand filters completes one phase of the treatment. Sludge and skimmings from the chemical treatment are thickened and dewatered on vacuum filters, preparatory to being trucked to disposal areas. Excess sludge from the activated sludge process is discharged to aerobic digesters with residues sent to the sludge thickeners.

"'Refining' Refinery Wastes." By John D. Frame. *Wastes Engineering*, July, 1959.

Spraying Fibrous Paperboard Wastes

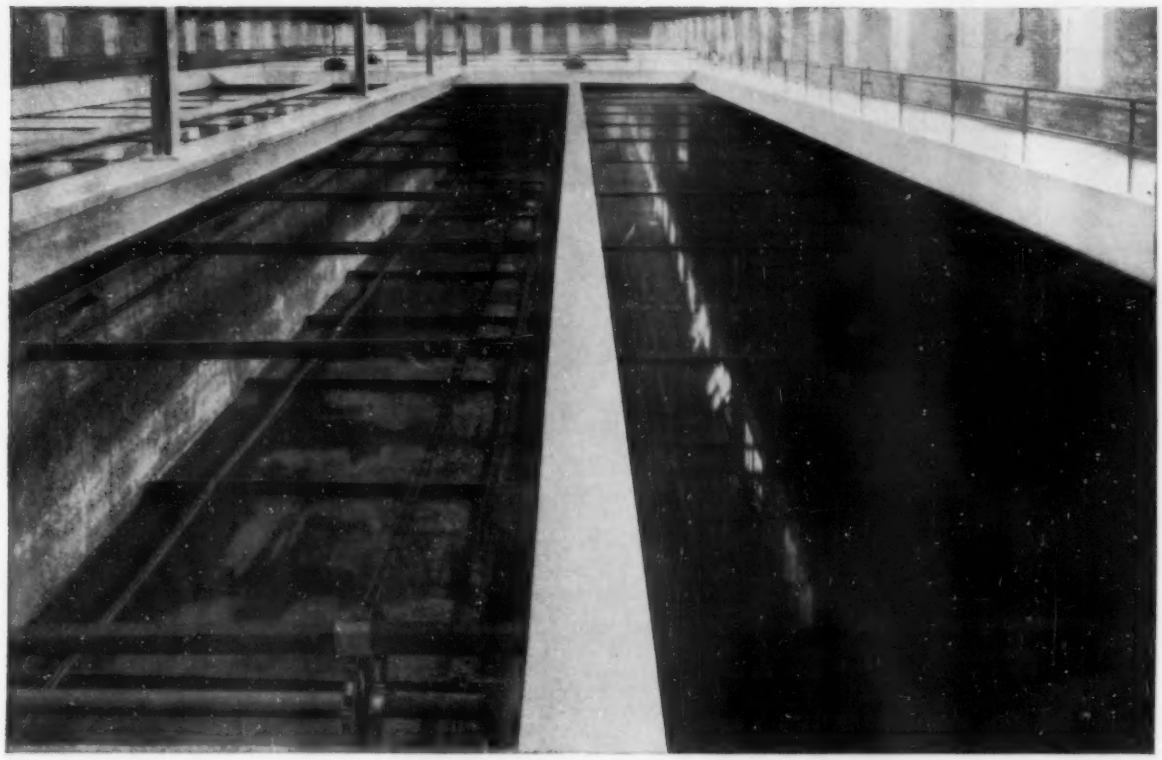
Spray irrigation seemed to be the best of the methods available for avoiding pollution of the St. Marys River (Ohio) by the discharges of the Auglaize Division Mill of the Weston Paper and Manufacturing Co. The method needed evaluating, however, and experiments were undertaken for this purpose using a limited portion of the waste. The paperboard mill produces wastes containing paper fibers in a concentration of about 240 mg/L in terms of suspended solids. Included also are starches, cellulose degradation products, rosin, lignin, sulfates and silicates. The BOD varies from 200 to 400 mg/L and the pH, 7 to 8. A 52-acre site which had been cultivated regularly was chosen. Crops that had been grown included alfalfa, timothy, corn and soy beans. The spray irrigation system developed consisted of a pump sump, a 6-in. galvanized steel header, and a distribution system of 5-in. aluminum tubing with galvanized steel couplers. Sprinkler heads, spaced about 210 to 240 feet apart over a 14-acre plot, distributed wastes over a radius of about 100 feet each. Application was intermittent. Records were kept of rainfall and dosage of the waste. By adding the average rainfall of 0.08 in. per day to the waste dosage, the total liquid application per day ranged from 0.21 in. to 0.56 in. It appeared that this application rate could be increased. No harm was done to the crops, and fiber accumulation was not evident. In winter some icicles formed on plants, but no operational difficulties occurred because of the high temperature of the wastes, about 90°F. Further experimental work will be undertaken to determine if any damage is done to chemical constituents of the soil and to establish the limits in the rate of liquid application.

"Experimental Spray Irrigation of Paperboard Mill Wastes." By Harold C. Koch and D. E. Bloodgood. *Sewage and Industrial Wastes*, July, 1959.

Waste Tars and Spent Catalysts

Petrochemical processes usually involve catalytic reactions and distillation. The spent catalyst from such reactions and residual tars from distillation are wastes requiring disposal. Before disposal methods may be prescribed, the wastes should be evaluated from the standpoints of identity of components, quantity, toxicity and utility in by-product form. Methods of disposal

The Rex Record at Racine, Wisconsin



Rex Primary Sludge Collectors at the Racine, Wis., sewage disposal plant. Rex Equipment at this plant includes longitudinal and cross collectors . . . grit collectors and washer . . . bar screen and triturator.

181,800 hours of continuous operation... with original equipment

181,800 hours of continuous operation... almost *21* years of service 365 days a year, 24 hours a day... that's the record Rex Conveyor Sludge Collectors have established at the Racine, Wisconsin, sewage treatment plant. Here's definite proof of the design and manufacturing superiority of Rex Equipment. Rex Z-Metal Chains, Temperim sprockets, case-hardened centralized wearing shoes, accurately made redwood flights and self-aligning underwater bearings, plus balanced strength, flexible design and the other Rex "extras," put extra life into Racine's Rex Conveyor Sludge Collectors... both longitudinal and cross collectors.

If you're interested in record service like Racine's why not investigate Rex Waste Treatment Equipment. In the broad Rex line, there's exactly the right choice for you... from screening to clarification. For all the facts, write CHAIN Belt Company, 4722 West Greenfield Avenue, Milwaukee 1, Wisconsin.

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are usually burning, burial or discharge to streams. Open pit burning is used but it should be done under strict supervision to prevent serious fires and air pollution. A recent modification of open pit burning provides the use of ground level burners in areas where fire is no problem and the tars can be stored. In burning the wastes in incinerators, metallic residues might produce hazardous fumes or dusts which must be trapped from flue gases. Likewise tars containing sulfur or chlorinated hydrocarbons can produce air pollution problems when incinerated. Calculation of maximum downwind concentrations of pollutants is possible and should be done whenever discharges are contemplated. Burial of the wastes is possible, using sanitary landfill methods or container disposal, but subsequent use of land and water supply pollution potential should be considered. If tars are soluble, direct discharge to streams at high dilution rates might be possible. Disposal at sea is being practiced in the Gulf of Mexico and off the coast of New Jersey, with success. This was done with the aid of oceanographic studies. Reclamation, particularly of metals, is possible and helps reduce the disposal problem.

"Tars, Spent Catalysts, and Complexes as Petrochemical Waste Sources." By Jack T. Garrett, *Sewage and Industrial Wastes*, July, 1959.

Quality Control for Oxidation Ponds

The disposal of canning wastes in Texas' Lower Rio Grande Valley had been an unsolved problem for nearly twenty years. Most of the activity centered at Weslaco, where the citrus industry was concentrated. After being placed under court order to abate pollution, the City of Weslaco employed a consulting engineer to work out a solution of the problem and design a new domestic sewage treatment plant. Based on results of studies made by a state-city-industry committee over a period of four years, the engineer specified oxidation pond treatment for the wastes. Two ponds were constructed with a combined area of 32 acres and based on a design loading of 50 lbs. of BOD per acre per day. The discharge structure was arranged to allow depth variations from zero to four feet. The domestic treatment plant consisted of high rate trickling filters. The operation of the ponds was started using sodium ni-

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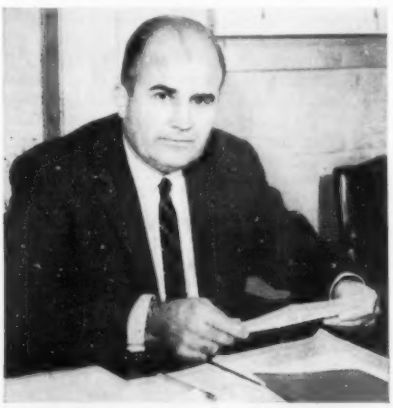

A. A. Kalinske, Vice President and Technical Director in charge of Research and Development.

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pumps almost everything

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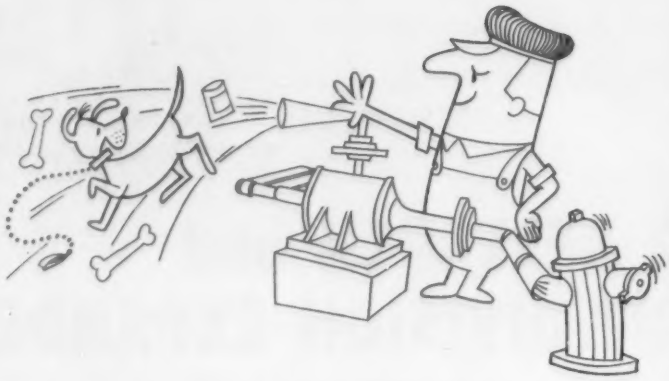

secret: recessed impeller; continuous open passage

(chances are it will work profitably for you)

Western Machinery Company 650 Fifth Street • San Francisco, Calif.

New Kelly-Creswell Spray Gun Makes Road Striping Easier

Kelly-Creswell Company, Xenia, Ohio, has a new automatic striping gun for use on highway and industrial road marking equipment. Gun is patented. The gun is diaphragm-operated which eliminates the air cylinder and upper packing gland found in most spray guns. This eliminates the greatest cause of air loss in automatic spray guns. The new gun requires about 25% less air to operate at peak efficiency.

The gun is being installed on all the various types of striping equipment made by Kelly-Creswell. Also available as a replacement part. Kelly-Creswell is a pioneer manufacturer of a complete line of road-marking equipment-truck-mounted, power driven and hand operated.

For additional information write

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20th year in exclusive manufacture of Striping Equipment

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trate treatment in the influent to the ponds plus the addition of effluent from the domestic sewage treatment plant. Sodium nitrate addition was discontinued after aerobic conditions were established. The dissolved oxygen and pH of the ponds were watched closely as the primary quality control criteria. It was found that a drop in pH indicated death of algae cells and a drop in dissolved oxygen signified conversion to anaerobic conditions. Several times after initiating operation, low pH and dissolved oxygen levels were observed, and conditions were immediately corrected by starting sodium nitrate addition. With this corrective procedure aerobic conditions have been maintained practically continually since operation of the ponds was commenced in 1955.

"Control of Canning Waste Oxidation Ponds." By N. E. Davis. PUBLIC WORKS, August, 1959.

Other Articles

"Condensates, Quenches, and Wash Waters as **Petrochemical Waste** Sources." By Harold F. Elkin. The principal problems created by disposal of condensates are those of taste, odor and oxygen demand. A number of treatment methods are available in addition to burning, dilution and deep well disposal. Sewage and Industrial Wastes, July, 1959.

"**Definitive Characterization** of Industrial Wastes." By M. B. Ettinger. As the competition for water resources between waste disposal uses and consumptive and recreational uses becomes greater, the industrial reuse of waste waters will become more attractive. Sewage and Industrial Wastes, July, 1959.

"Cleaning Up **Tube Mill Wastes.**" By John S. Bethel, Jr. Reducing copper, zinc, chromium and sulfuric acid concentrations is accomplished by pH control and chemical precipitation. Wastes Engineering, July, 1959.

"Treatment of **Phenolic Wastes.**" By G. Gutzeit, E. J. Lyons, and D. C. MacLean. The article describes the application of a counter-current extraction method using a rotating disc contactor. Industrial Wastes, July, 1959.

• • •

Columbia Water Plant Enlarged

Columbia, South Carolina, has a daily water plant filter capacity of 36,000,000 gals., after completion of some $7 million worth of construction and installations.

Recently put into operation were six new 1½-mgd filter units, two new 6-mgd settling basins with flocculation equipment, new chemical-feeding machines and a chemical agitator. These raised the plant's capacity by 9 mgd.

"Wherever Water Flows STEEL PIPES IT BEST"

It's "in very good condition" after 47 years of rugged service

The scene is near Denver. The pipe is steel, 60 in. ID, with ⅜-in. walls.

This big main has been delivering raw water to the city since 1912 under conditions about as tough as you'll find anywhere. The pipe is above ground, exposed to winter temperatures as low as 20 degrees below zero. But, after 47 years, the Water Department reports: "This pipe is in very good condition and is still giving satisfactory service."

With today's vastly improved lining, coating, and wrapping techniques, there is no known limit to the effective service life of large-diameter steel pipe. What's more, because of steel's unequalled combination of great strength and ductility, steel pipe is unharmed by stresses that would damage more brittle materials.

And remember, *every length* of steel pipe is hydrostatically tested in the shop in accordance with AWWA specifications!

You can specify steel fabricated pipe with confidence.

STEEL PLATE FABRICATORS ASSOCIATION

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Chicago 2, Illinois

OXIDATION OF ORGANIC WASTES IN STABILIZATION BASINS

WILLIAM M. STEINFELDT,
Eastman Kodak Company
and
JACK T. GARRETT,
Monsanto Chemical Company,
St. Louis, Missouri

FOR THE purposes of this paper, a lagoon is an impoundment, usually accomplished by damming up a natural watershed, used for storage, dilution, settling or some other function that is not connected specifically with encouraging biological growth. On the other hand, a stabilization basin or oxidation pond is an impoundment with a controlled depth, usually of regular geometric shape, where biological growth is encouraged for the purpose of consuming contaminants as food. The oxygen balance is controlled in the oxidation pond wherever possible, whereas in the lagoon, little consideration is given to this balance(1).

The stabilization basin is not an alternate to the trickling filter or the activated sludge process in a percentage of those plants requiring a biological treatment method for removal or reduction of organic chemicals in the plant effluent. However, research and application of this process to industrial effluents will undoubtedly expand the usefulness of the process beyond its present somewhat limited applicability.

The most significant factor in whether a basin is a feasible alternate or not is land cost. For comparison purposes, let us assume that in the stabilization basin, the land is the major cost item, with equipment minor. On the other hand, the cost of land for a treatment plant would be, in most cases, minor in comparison to the cost of construction and equipment. Several years ago, a figure of $100 per pound of BOD per day of removal capacity was given as the cost of trickling filter construction(2).

On this basis for 10,000 lbs. of BOD to be removed daily, we would estimate $1,000,000 as the cost of the trickling filter treatment system. While higher figures have been reported, 50 lbs. of BOD removed per acre of oxidation pond surface appears to be a reasonable design value. Thus for the same BOD removal load, 200 acres of oxidation pond would be required. At a land cost of $5,000 per acre, the two methods, the stabilization basin and the trickling filter, are equal in initial cost. Land acquisition costs of over $5,000 per acre could easily be incurred in acquiring land in a populated area. On the other hand, if the land cost only $100 per acre, the stabilization basin becomes financially attractive.

The $5,000 per acre break-even point above was mentioned only to show the influence of land cost on the economic feasibility of stabilization ponds. This figure should not be used as any hard and fast rule, since local conditions might make the break-even point significantly different. An advantage of the stabilization basin lies in the fact that land is one capital item which does not depreciate.

Disadvantages of Stabilization Basins

There are disadvantages associated with operating stabilization basins. If a dike wall breaks, a considerable quantity of water may be released to the receiving stream, polluting it for many miles downstream. The solutions lost from a stabilization pond are no more toxic or strongly pollutional than from any other system, but the volume, and thus the consequences, are greater in the case of the stabilization basin.

In areas with very permeable soils or permeable rock strata, seepage of polluted waters into the ground could pollute potable water strata. However, sealing of the basin bottom to hold four or five feet of water head should not be an insoluble problem.

Insect breeding, particularly mosquitoes, has been cited as one of the disadvantages of the oxidation pond, and some basins have been stocked with minnows as a mosquito-control device. A more serious potential problem is the possibility of taste and odors in oxidation pond effluents from micro-organisms which develop in the pond. Some of the algae and fungi are known to be potent taste and odor producers (3)(4)(5)(6)(7)(8). How serious a problem this could become if the use of oxidation ponds increases, is problematical. At the present time, no case of serious impairment of a public water supply from an oxidation pond effluent has been reported.

There are several factors that must be considered in addition to those previously mentioned in selecting oxidation ponds for biological waste treatment. Weather conditions are the most important of these. The amount of natural sunlight and the number of days of sub-freezing weather greatly influence the efficiency of this process. The present loading standards established for North Dakota and Texas, for example, are significantly different because of more favorable weather conditions in Texas. Thus the effect of weather influences loading rates and therefore treatment costs(9).

As previously mentioned, the number of days of sub-freezing weather adversely influences the reaeration rates, the degree of light penetration and the bacterial activity and becomes one of the major factors in nuisance-free operation of stabilization ponds. If an industrial stabilization basin were operated under heavy ice-cover for considerable periods of time, the warm weather could bring with it nuisance conditions from anaerobic oxidation due to poor oxygen balance. Few industries can afford the adverse publicity which would be incurred by such a situation.

Light penetration is also a significant variable in operation. Since

much depends on photosynthetically produced oxygen, light penetration is critically important. This variable is generally of more significance to the industrial operator than to his domestic counter-part because of the prevalence of color in industrial effluents (particularly organic chemical). The oxidation pond is not a wise choice for treating highly colored wastes, unless color removal can be accomplished in some primary device. The mechanical addition of oxygen to waste ponds has been advocated and practiced in some locations, but this alters the process from an oxidation pond to a hybrid (9) (10).

Topographical Conditions

Local topographical conditions have considerable effect on the costs of oxidation ponds and can also affect treatment efficiency. There are many areas in the country where it would be impossible to find 200 acres of land where the elevations would allow a single pond of this size. The stabilization system in this case would require multiple ponds which would make land acquisition and pond construction costs higher in general. In addition to higher costs, smaller ponds generally have less wind-induced wave action and consequently less oxygen available because of lower reaeration rates. Since these ponds depend to a great extent on wave action for mixing, smaller ponds often contain areas where mixing is poor. This is particularly true in narrow ponds of those which have irregular shorelines (9) (10).

In a stabilization basin (11), we are primarily concerned with algae, fungi and protozoa although higher animal forms are also reported to be present. In any basin, it is going to be almost impossible to have a pure culture or to restrict to any one set of organisms. The culture which develops is that which is best suited or which best adapts to the particular environment of the basin. Nutrients may be added to favor growth of certain organisms. Temperature and pH are also factors in controlling growth. Seeding with specific organisms seems questionable.

Algae are plants, and like all plants, convert carbon dioxide to oxygen and cell material. Sunlight is as essential to algal photosynthesis as to any plant's photosynthesis. The role of the algae is to provide the oxygen necessary to the oxidation of the organics by other microorganisms such as bacteria or protozoa.

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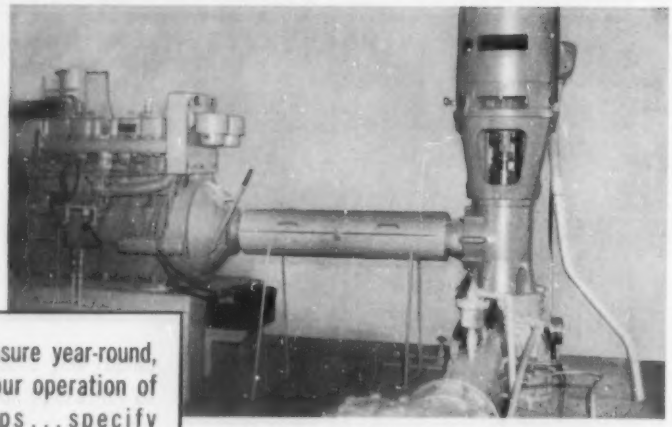

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4

Fixation of the carbon of the carbon dioxide as cell material by the algae means that some of the BOD, which was converted to carbon dioxide by bacteria, has been reconverted to organic material which can exert a BOD later when the cell dies. In this manner algae tend to undo the purification which other micro-organisms have done. How many steps forward for every backward step has not been thoroughly developed. The fact that stabilization basins do work would indicate that this algal cell BOD is not a major factor. Also, cell material is said (12) not to be as putrescible as sanitary sewage.

Algae, being plants, require oxygen when adequate sunlight is not available for photosynthesis. The diurnal variation of the concentration of oxygen in a stream is also found in stabilization basin. During the night, algae require oxygen and bacterial oxidation of organic chemicals is impaired by the resulting low dissolved oxygen. Studies in the activated sludge process indicate that concentrations below one mg/L impair the process and some comparable action could be expected for stabilization basins.

Generally it would appear that a stabilization basin designed on the basis of a loading of 50 lb. BOD/day per acre of surface will be satisfactory. This is based on the average plant load and assumes that peak loads will not persist several days. Stabilization basins have been said to tolerate overloads better than conventional processes. However, this may be largely the result of mixing the overload into the very large volume of the basins. Satisfactory operation under higher loadings have been reported for sanitary sewage of 83 lb. BOD/day per acre (13); for kraft mill effluents of 130 lb. with 80 percent removal (14); for an organic chemical plant nearly 100 lb. with 95 percent removal (15); and for a petrochemical plant, 75 lb. with 90 percent removal (16). Reportedly, a loading of 40 lb. BOD/day per acre will be supplied by aeration alone, without photosynthesis (17), although other investigators set this figure at 20. A rational approach toward the design of an oxidation pond, with respect to algal action, has been developed (19). This approach permits determination of how much oxygen an algal culture will supply, and does not attempt to cover the amenability of organics to biological oxidation.

The normal depth for stabilization basins appears to be 4 to 5 ft. Shallower basins apparently are more

effective for algal aeration, but vegetation growth may be a problem. A pond working effectively at 9 feet has been reported (18).

We believe that the stabilization basin is a sound method of providing biological oxidation of a plant effluent. In considering whether this method should be used, the availability of land should first be investigated. The successful use of stabilization basins on a rather wide variety of plant effluents indicates that if a waste will be amenable to any kind of biological treatment, it will be amenable to oxidation in a stabilization pond. However, keeping in mind other cost considerations and considering the diversity of chemical products, pilot planting of a new waste in a stabilization basin would be practically mandatory.

This paper was presented at the MCA Joint Air and Water Pollution Abatement Conference held at Cincinnati, Ohio, in March, 1959.

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A competitive examination for the appointment of sanitary engineers as officers in the regular corps of the Public Health Service will be held Nov. 17-20, 1959. Appointments will be in the three lowest commissioned grades. Completed applications must be in by 9 October. Write the Surgeon General, Public Health Service (P), Washington 25, D. C.

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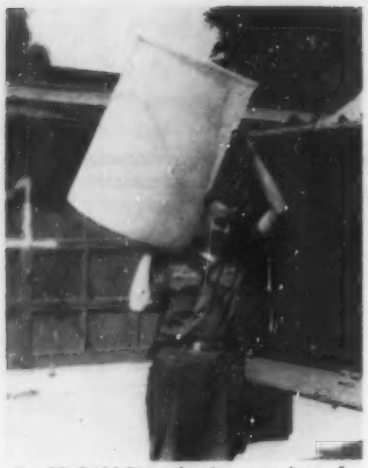

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MANY residential communities like Babylon, Long Island, throughout the country offer their residents what is variously called Back Door Service, Carry-out Service or Tub Service. The homeowner need not bring the pails to the curb in this system. The collector goes to the rear of the property to carry the refuse to the truck.

"A garbage collector doing back door service has one of the most strenuous occupations known" says Bill Brown, Supervisor of Public Works of the Village of Babylon. "I feel responsible as their supervisor to do what I can to make that work easier for my men".

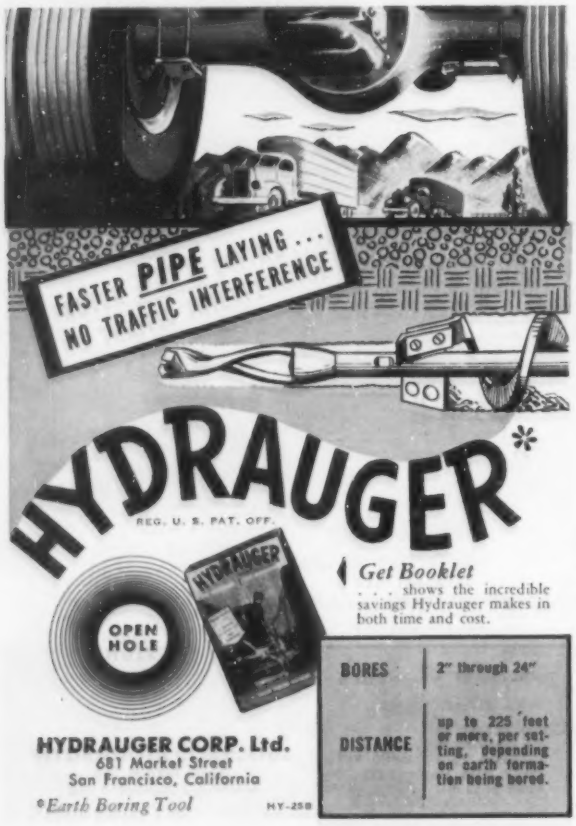
The collector in this type of service spends almost half of his working day with a large container filled with refuse on his shoulder. Obviously the nature of this container—its size, shape and weight—is an important factor in the overall efficiency of the operation.

Mr. Brown had never been satisfied that his men were being supplied with a vessel that would ease their burden but at the same time allow for a maximum of efficiency. A capacity of about 50 gallons is needed to accommodate the contents of several 20-gallon garbage pails so as to minimize the number of trips to the rear of homes. It is often desirable to collect from two or more adjacent homes before returning to the truck to dump.

A neighboring community was using boxes in which tea is imported from India for their collection vessels. These are cubical boxes of wood veneer with steel angles reinforcing the edges and corners. Arrangements were made for a supply of these but it was soon found that their small size and tendency to absorb water made them far from ideal. Lard cans, bakery tins and barrels of all sorts were tried, all with little success. Attempts were made to render cardboard boxes waterproof by chemical means and presumably extend their lifespan under hard service.

A container in use in back door service is dropped to the ground several hundred times a day and dashed against a steel hopper as often. This enormous abuse apparently breaks down the normal strength of a material. Mr. Brown came into contact with The County Chemical Co., of East Meadow, Long Island, and they agreed to execute some of Brown's ideas on making a collection pail.

A rectangular aluminum box with angle reinforcement along each edge



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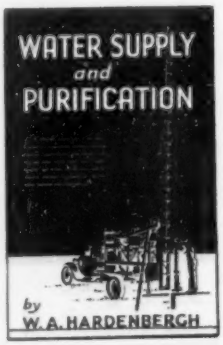
by Col. W. A. Hardenbergh



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and a fiberglass box in the form of a 2-ft. cube were used but were not satisfactory.

Several plastics were experimented with and an important effect was observed. The thinner and lighter the box was made the longer it seemed to resist cracking and wear. This was believed to come about because the repeated impacts of dropping and dumping had less weight behind each shock. Based on this, a light flexible 50-gallon cylinder was made of "Tuflite" plastic. It weighed only six pounds. Several were put into use and good results were obtained. After two months the units were still in good shape. The flexibility posed a problem, however. Men unaccustomed to them found that they did not have the right feel. This was solved by introducing a steel stiffening ring at the top. Here at last was a container of the right size — low in weight, long lived and one which the collectors enjoyed using.

A large quantity of Back-Door Boxes as they are called are now in use. One day one of the collectors bid a reluctant farewell to his box as it disappeared up the elevator of his packer truck. However, when it was fished out of the load for final obsequies it was found that a few prods popped it back to its original shape and into new life and service.

• • •

Status of Federal-Aid Highway Program, May 1959

Construction contracts on 238 miles of the National System of Interstate and Defense Highways, including 237 bridges, were awarded during the month of May at an estimated cost of $144 million. Figures from the Bureau of Public Roads, U. S. Department of Commerce, showed that preliminary engineering worth $5 million and right-of-way acquisition estimated to cost $43 million were authorized during the month. Construction contracts were completed in May on 122 miles, including 188 bridges, at a cost of $91 million.

As of May 31, construction was under way on 5,154 miles of the Interstate System, at an estimated cost of $3.21 billion. Construction contracts have been completed since July 1, 1956, on 3,807 miles at a cost of $1.23 billion. Included in the program were 5,186 bridges under way and 2,735 completed. In addition, $2.05 billion had been authorized or spent for preliminary engineering work and acquisition of right-of-way since July 1, 1956.

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IN THE management of any business, it is a matter of primary importance to guard against the hazard of financial loss due to damage of physical properties and plant operations resulting from a sudden catastrophe. Because of the inordinate investment required to provide the facilities necessary for the generation and distribution of electric energy, this is especially true in the operation of an electric utility system. Failure to insure adequately against such hazards might affect seriously the ability of a small system to carry on its business with financial solvency.

In municipal system ordinances and resolutions covering most revenue bond issues, the need for insurance coverage protection is made a mandatory and contingent requirement for the issuance of bonds, through language similar to the following:

"The municipal system will keep, or cause to be kept, the works, plants, and facilities comprising the properties of the electric system insured, and will carry such other insurance, with responsible insurors, against fire and other risks, accidents, or casualties at least to the extent of the kinds that insurance is usually carried by corporations operating like properties in the same area."

Based on the preceding requirements, it is apparent that no two utility systems are apt to carry exactly the same proportional insurance coverage protection on each and every component of their respective system facilities. Past experience on equipment failure in a severe lightning and thunderstorm area of a given utility would dictate the need for adequate lightning insurance coverage. Another utility, in a mild thunderstorm area, might not consider the need for such coverage to the same degree.

Certain units of property, because of their arrangement in the system and their relatively low value, are not covered by insurance. Such items would include the poles and cross-arms of a distribution feeder pole line. If lightning were to strike the pole line, it would damage only the pole at the point of contact and the line for only a span or two away; all of the other poles, in general, would remain free from damage, and the feeder could be repaired and put back in service at relatively low cost.

On the other hand, if lightning were to strike a large substation transformer the concentration of damage and the cost of its repair would indicate the need for insurance coverage of the transformer.

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1. *Fire, Lightning, and Extended Coverage Insurance*: In this form of insurance, extended coverage includes losses due to windstorm, hail, explosion, riot, aircraft, vehicles, smoke, etc. Except in case of a windstorm, damage to electrical equipment from artificial sources is not covered unless fire ensues, in which case the total loss is collectible.

Types of property covered by such fire insurance include the insurable parts of facilities such as the following:

Generating Stations: Buildings, contents, and outdoor equipment.

Substations: Buildings, contents, transformers, regulators, outdoor equipment, etc.;

Underground Transformer Vaults: Equipment only;

Owned or Leased Buildings: Contents and outdoor equipment. Items not generally covered by such insurance include land, foundations and underground facilities, tunnels, excavation, backfill, etc.

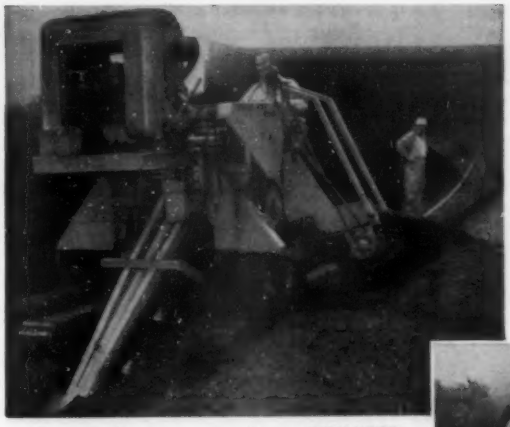
2. *Boiler and Machinery Insurance*: This insurance covers specified items of plant equipment for only the particular type of damage stipulated in the policies for each item. Such coverage includes:

Boilers—Broad Coverage: Provides for losses from accidental explosion, cracking, bulging, or collapse of a boiler and associated piping due to steam or water pressure. Losses due to fire or furnace explosion are generally covered by fire insurance policies. Boiler coverage insurance is also applicable to steam or air pressure damage to unfired pressure vessels.

Turbines — Breakdown Coverage: Covers losses from an accidental or sudden breaking of the turbine or any part into two or more parts; the burning out of the turbine or any part thereof; the deforming of any rotating part; or the loosening of any wheel, disc, or blade ring on the rotor, spindle or shaft within the turbine.

Loss of Capacity Coverage: Applicable to cover losses due to operating less efficient units, or purchasing power during an outage caused by covered physical damage to specific objects insured in the policy.

In addition to the above types of insurance policies for utility property, there are many types of insurance coverage applicable to provide for losses resulting from system operations, over and above self-insurance maintained by the utility, such as:



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Excess Liability Insurance: Includes coverage of a stated amount over a stated self-insured amount for workmen's compensation, employer's liability, public bodily injury liability and property damage liability.

Owner's, Landlord's, and Tenant's Liability: Protects the utility against public liability and property damage claims resultant from accidents occurring on the utility's premises.

Automobile Liability and Property Damage: Protects the utility and its employees against damage by listed automobiles or substitute cars.

Miscellaneous policies are often carried which are peculiar to the individual system. Such policies include sprinkler leakage (on general office buildings and perishable goods warehouses) and plate glass insurance on display room windows, etc. The latter type of insurance is generally more applicable in new installations due to settlement strains, possible poor installation or construction operations.

The determination of the amount of insurance coverage which should be carried by an individual utility presents a difficult problem which warrants the assistance of insurance underwriters' representatives. Published data are not available regarding the amount of insurance coverage carried by utilities throughout the country; however, the Federal Power Commission's statistics regarding private electric utilities publishes the amounts applicable to insurance cost as an item of administrative and general expenses. Such insurance expense includes the cost of insurance in the form of premiums paid to insurance companies and special costs incurred in procuring insurance. As such, these expenses offer a measure of the amount of insurance coverage carried by the reporting utilities for financial protection against the hazards of fire, boiler and machinery breakdown and explosion, storms, lightning, etc.

Based on an analysis of fifteen large companies as reported in the 1957 FPC Statistics, the ratios of "Insurance Expense" to "Total Utility Plant, less Reserves," range from 0.027 percent to 0.0861 percent, with an arithmetic average of 0.0543 percent. On this basis, it is possible to compare the equivalent ratio for a given utility to determine the relative extent of the utility's protective insurance program.

Consulting Engineers

(*Continued from page* 112)

proper percentage of the total cost of engineering assigned to it, in advance, so that as the work proceeds from one phase to another, both the consulting engineer and his client will have a fair relationship. For most phases of municipal work, the percentage of the total fee assigned to the preliminary study and report ranges from 15 to 25, averaging 20; for preparation of construction plans and specifications, from 50 to 65, averaging 55; and for general supervision of construction 20 to 30, averaging 25.

If field surveys are required, or if special data must be collected, or if supervision requires a resident engineer, a standard method of charging for these services is suggested, and these charges are over and above the fee based on the percent of the construction cost mentioned above.

Both consulting engineer associations and organizations of public officials suggest that the official be wary of the occasional consultant who offers to undertake engineering work on a "free" or "reduced fee" basis. This offer is most commonly made in the preparation of the preliminary study or engineering report. The compelling force behind this practice is to be assured of being retained to design the project when it proceeds. This is a dangerous and highly unethical practice, and upon reflection, the reason for it is quite evident. By the time the preliminary report and study have been completed, most of the major decisions, with regard to the proposed project, have been made. If this study had been made on a free, or cut rate basis, naturally the required effort in finding facts, analyzing these facts, and in making the necessary engineering studies and judgments, are generally short cut, just as the fee has been. The end result is incorrect analysis, costly errors in judgment, and expensive or improper approach to the solution of the problem. These initial mistakes are usually carried right through the design stage into construction. The public official should insist that the preliminary phase of the work be thoroughly done and that the engineer should charge at least 15 percent of the total engineering fee for it.

Public officials should likewise be wary of any offer by contractors, equipment manufacturers or utilities' representatives, to do "free en-

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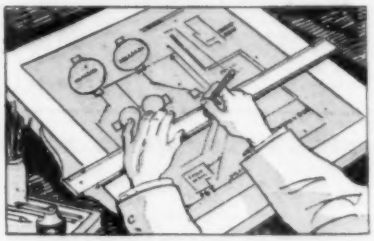

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gineering." Engineering is never "free." When it is done on a so-called "free" basis, it is always covered up somewhere in the product. Only the independent consulting engineer can give the public official the unbiased advice and consultation that he needs for he is unencumbered by self-interest in the sale and profit from any equipment, materials or construction which may follow. Engineers are governed in their relations with each other, with the public and with their clients, by detailed and extremely high ethical standards. These "codes of ethics" are printed documents, obtainable from the National Society of Professional Engineers, Washington, D. C., and the Consulting Engineers' Council, Springfield, Illinois.

Selection of an Engineer

Although many factors may enter into the selection, it is suggested that all factors be held in their proper perspective. Yardsticks which are suggested as significant in weighing the qualities of a consultant or a consulting engineering firm are: Size of the firm; education and experience of its key personnel; the firm's specialties and its ability to handle all phases of the work under consideration; ability of the firm to complete the job on time; overall philosophy, integrity and ethical standards of the firm; location of the firm relative to the job; and financial status and permanency of the firm.

The size of the firm is not always an indication as to its quality, but it is more likely that a moderate to a larger size firm will be able to give the services required on larger and more important work. They are also more apt to have the variety of specialists who are accustomed to working as a professional team.

The client, in investigating the professional engineers relations, might inquire of the contractors and former clients as to whether the engineer's dealings with them have been fair, and still in the best interest of his clients. A practice employed by a very few consultants should likewise be avoided; namely, that of copying large portions of similar jobs, rather than making an independent engineering study and design, particularly applicable to the new job. The public official should also be wary of the consultant who is consistently recommended by a contractor, or equipment manufacturer, because it is possible that the consultant so recommended will become "obli-

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gated" in a manner which may not be to the best interest of his clients. Such people are also few and far between, but they do exist.

In selecting a consulting engineer, the city official should request professional record information from the better consultants in the area practicing in the type of work desired. Most consultants have this in a printed or mimeographed form. These brochures generally describe the education and experience of the key personnel, tell what type of work they specialize in, and list typical jobs and clients with which they have been associated. They may also list the special consultants which they use on an associated basis.

The next step is to interview representatives from two or three of the best firms picked by study of their brochures. During these interviews, the officials should ask the consultants to enlarge on their background and experience, particularly as it related to the problem at hand. They should ask them questions concerning the size of the firm, their ability to complete the work on time, their ways of doing business, and only in general terms concerning his fees, or fee schedules. The municipality may wish to contact other municipalities for which the consultant has done work and his financial or other references. They may even wish to talk to some of the contractors who have done work under his supervision.

When the job is of a particular nature requiring special talents, special consideration should be given to the firm best qualifying in these areas. A good example is in the case where a consultant is needed to design a water purification plant, or perhaps a sewage treatment plant. These are specialized areas requiring highly qualified sanitary engineers.

Preferably the sanitary engineer included in the firm of your choice should have a minimum of one year of graduate study in sanitary engineering; should be an accredited specialist in water and waste water treatment by the intersociety Professional Board, and should be a member of the American Academy of Sanitary Engineers; should have had good design training under competent experienced sanitary engineers; and should have had either supervisory or direct operating experience in water and sewage.

Similar qualifications can be laid down for specialists in such fields as soil mechanics, structures and hydraulics.

Two obvious steps have already been recommended. After selection of the engineer by following proper procedures, negotiate with him a fair and adequate means of compensation. The client, or public official next owes the consulting engineer a very thorough briefing of his task. Endeavor to leave the consultant with as free a mind as possible in pursuing the solution of the problem at hand, and yet give him the framework and the limitations of the problem, as seen by the municipality.

Make available to him all basic data and information which is presently available both in the municipality's office, and from other public and private sources. All of these data will help him analyze the problem and conceive the most practical and economical design.

Before the consultant has proceeded too far in his preliminary investigations and study, give him an opportunity to coordinate the principal elements of this study with the public officials, and thereby be kept on the right track. When minor political considerations interfere with moderate to major engineering considerations, conflicts may result. It is never well to use the engineer as a tool, or ask him to doctor his technical considerations for the sake of political ends. It may, however, be good to use the consultant with his prestige and unbiased technical approach, as a means of resolving and overcoming minor political considerations.

Where a former political administration had, with due care, selected a competent consultant, it is inadvisable and to the detriment of the community to attempt to discredit the consultant, and seek another with a view toward gaining the political favor of the public. The consulting engineer and his relations with the city should always be above politics.

Use the advice and counsel of the consulting engineer in all matters in which he is qualified, and work out with him suitable means of compensation. The consulting engineer is a professional man, rendering a truly professional service. The most can be gotten from the consulting engineer when he is kept strictly in this professional climate. Keep him here, and he will serve you as you would like to be served.

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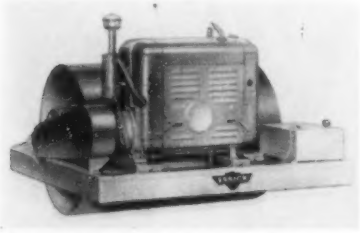
Air-Operated Sump Pump

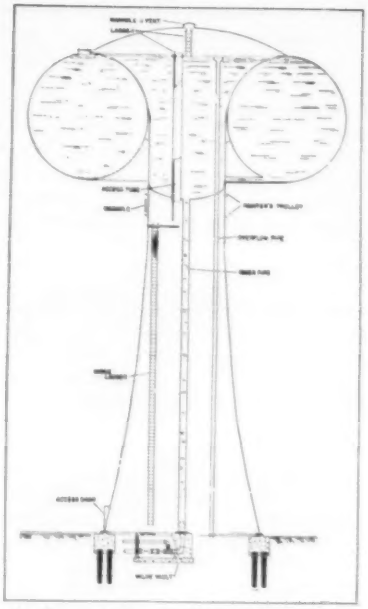
A new air-operated sump pump made with a durable, long-life steel casing and weighing 56 lbs. is announced by Worthington. The WAP-100, as it is called, will operate on a 75 cfm or larger compressor with air pressures from 60 to 100 lbs. A design feature called the air exhaust check valve prevents water from entering the air motor even when the pump runs submerged, while the semi-screw type impeller removes all but the bottom inch of water in the sump. For further information write Worthington Corp., Holyoke, Mass., or circle **No. 9-1** on the reply card.

Vibrating Compactor

The new Model VR-72-TEC high frequency vibrating compactor has been announced by Essick. The engine is close coupled to the drive shaft and V-pulley, which drives the vibrating mechanism. The compactor is driven by an F226 water cooled Continental engine equipped with a master hand-operated clutch, and an automatic clutch controlled electrically from the operator's seat. The hand operated master clutch between the engine and V-pulley permits idling and warming of the engine. When this lever is engaged, the automatic clutch goes into operation and engages the vibrating mechanism at a predetermined engine rpm. With the 72-in. wide vibrating compactor, a 17-ft. wide path on one pass with three VR-72 units in triplex hook-up can be accomplished. More details from Essick Mfg. Co., 1950 Sante Fe Ave., Los Angeles 21, Calif., or circle **No. 9-2** on the reply card.



Essick high frequency vibrating compactor has 72-in. width of compaction



Single central supporting column eliminates need of struts and tie-rods

Large Capacity Elevated Water Storage Tanks

A new design in large capacity elevated water storage tanks for municipal and industrial use, which features a single central supporting column, is announced by Graver Tank. Capacity of the Aquator ranges from 300,000 gallons to 3 million gallons and more. It is designed for large-capacity municipal installations as well as for special industrial applications. Major advantages of the Aquator are clean, distinctive appearance, lower maintenance costs, more constant water pressure and no pump house needed. Dimensions for a typical Aquator with a capacity of 1,500,000 gallon capacity would include a torus tank 94 ft. in diameter and 34 ft. in height (head range); and a column diameter of 46 ft. at the ground narrowing to 23 ft. at the tank. Complete data from Graver Tank & Mfg. Co., Div., Union Tank Car Co., 4809 Tod Ave., East Chicago, Ind., or circle **No. 9-3** on the reply card.

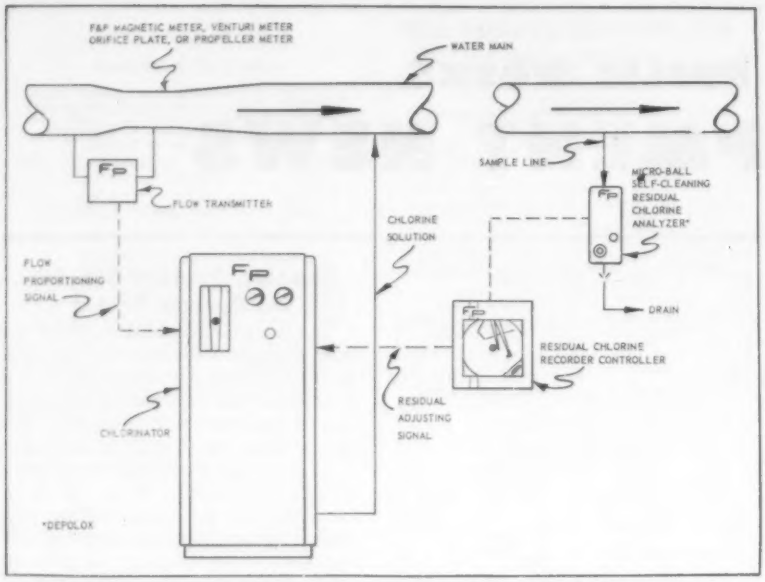
Compact, Portable and Easy to Operate Printer

Top quality prints in minutes are now possible with the new Satellite printer. Compactly designed, 5 x 5 x 44 in., it can be hung on a wall or placed on a shelf or table. One dial controls the speed and permits exact reproductions from any translucent original. It handles prints up to 30 in. wide and any length. More data from Eugene Dietzgen Co., 2425 N. Sheffield Ave., Chicago 14, Ill., or circle **No. 9-4** on the reply card.

Barber-Greene Wet Collector Series Meet Most Rigid Pollution Codes

Designed for use with all sizes of Barber-Greene continuous-mix and batch-type asphalt plants, as well as for application to asphalt plants of other makes, Barber-Greene's newly announced Models CN-50, 60 and 70 wet collectors, are designed to meet the most rigid air pollution codes. Employing an entirely new principle of operation, these new collectors utilize a dual compartment design, dividing the wetting and recovery phases for finest control over each phase. Since the wet collectors are equipped with independent fans and power units, they impose no additional back pressure on the dryer and dry dust collector. Thus, with the addition of a Barber-Greene wet collector, there is no reduction in dryer capacity. This offers the use of a unique advantage over conventional equipment. Complete information and specifications from Barber-Greene, 400 No. Highland Ave., Aurora, Ill., or circle **No. 9-5** on the reply card.

There is no reduction in dryer capacity with the addition of the wet collector



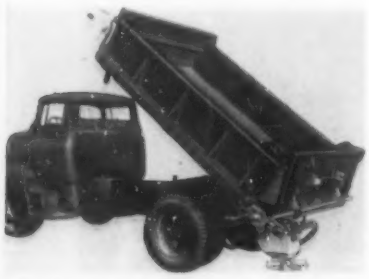
Self-cleaning analyzer may be used alone or in combination with flow rate control

Self-Generating Residual Chlorine Analyzer

A new residual chlorine analyzer featuring Micro-Ball self-cleaning electrodes is available from Fischer & Porter. Known as the "Depolox," the new analyzer generates a current, by means of two dissimilar metal electrodes, in proportion to the amount of free or total residual chlorine in the line. Residual is recorded in parts per million on standard recorder charts. The Micro-Ball consists of the use of a number of extremely small glass balls which circulate across the surfaces of the electrodes keeping them clean. Clean electrodes assure accurate readings. The Micro-Balls are retained in the electrode chamber permanently. Thus, clean electrodes with correct readings are assured at all times without the need for remembering to add a scouring agent. Furthermore, there is no danger of clogging through the introduction of extraneous cleaning materials. For complete information write Fischer & Porter Co., 218 Jacksonville Road, Hatboro, Penna., or circle **No. 9-6** on the reply card facing page 37.

Completely Hydraulic Tailgate Spreader Spreads 5 to 40 Feet

Continuously variable dual-hydraulic cab controls which permit the driver to regulate instantly the width and depth of the spread is the outstanding feature of the new Hi-Way Model "TG" tailgate-mounted spreader now available from Highway Equipment. The spreader is operated by one man who can choose any spreading width from 5 to 40 ft. by touching a fast-acting hydraulic control in the cab. A second hydraulic control regulates the flow of all materials, handling sand, salt, chips, cinders and calcium chloride. Designed for either ice control or sealcoating work, the unit also features a stabilizer bar which keeps the 18-in. diameter spinner level at all times, regardless of the dump body angle. The Model "TG" can be mounted in a matter of minutes without the necessity of removing the tailgate from the dump body. It can be installed on any standard dump body measuring 6½ to 8 ft. in width. Complete specifications from Highway Equipment Co., Dept. H-41, 616 "D" Ave., N. W., Cedar Rapids, Ia., or circle **No. 9-7** on the reply card.



Ice control or sealcoating spreader

New Line of Couplings and Fittings

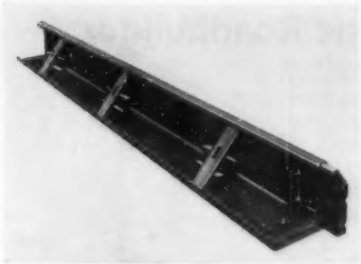
A complete new line of couplings and fittings for joining grooved-end pipe has been announced by Dresser. Designated the Dresser Style 98, Kupl+Lok, this new line presently includes couplings, ells, tees, reducers and line caps.

Style 98s are available in two complete series, the 98-1 for working pressures up to 500 psi, and the 98-2 for working pressures to 1000 psi. Bodies are of rugged malleable iron and are Dresser Red-D shop-coated to provide corrosion protection. Bolts are oval-neck, track-type of heat-treated carbon steel to ASTM standards and are black with an oil finish. More data from Dresser Mfg. Div., Bradford, Pa., or circle **No. 9-8** on the reply card.

Wemco Announces New Pump

A submersible model of the Wemco torque-flow pump is now available. It incorporates the same recessed impeller found in standard torque-flow pump models. This eliminates troublesome close internal case clearances and makes it trouble free and completely non-clog. The complete unit may easily be moved from wet well to wet well affording a portable dewatering service. The pump is specially designed with a close coupled motor for compactness and mobility. Available in both 3 and 4-in. sizes, the 4-in. size is only 18 in. in diameter and 28 in. high including the motor. The supporting legs are cast as a part of the pump casing and are designed to elevate the intake port from the sump bottom. More information from Wemco, a Division of Western Machinery Co., 650 Fifth St., San Francisco, Calif., or circle **No. 9-9** on the reply card.

Shown is the Wemco torque-flow pump which comes in both 3 and 4-in. sizes



Improved Road Forms

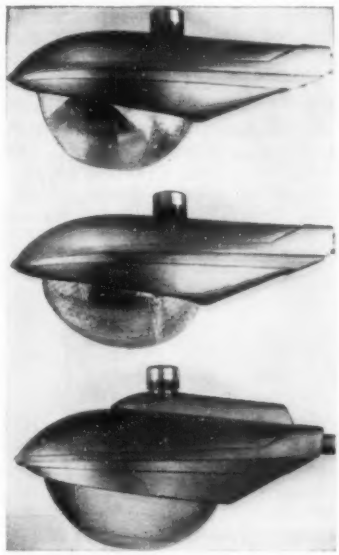
The Rex road form line is manufactured in single or double wedge design with slotted stake holes for automatic alinement. Stake pockets are closed, thus eliminating concrete and gravel build-up, and all pockets are electrically welded to the form face and base. Form ends have extra ½-in. steel reinforcing plates providing a ½-in. total end thickness and are cut at an angle to facilitate inside radius work. Full-depth, ¼-in., steel lock-joint plates assure maximum bearing surface and load transfer. Complete details from Chain Belt Co., Milwaukee 1, Wisc., or circle **No. 9-10** on the reply card.

Transistorized Intersection Receiver-Decoder

Motorola has added to its radio traffic control equipment line a completely transistorized intersection receiver-decoder, designed to minimize any on-street maintenance. The inherent reliability of transistors themselves greatly reduces the need for receiver servicing. The intersection units receive and decode tone signals from an automatically programmed radio base station. Signal voltages are fed into the standard traffic signal controller at the intersection, providing offset synchronization and time cycle changes to coordinate traffic flow. The unit, which contains a radio receiver, power supply, relays and tone determining elements is capable of providing supervision of any three of 17 different time cycles at an intersection. The housing is of rugged, lightweight aluminum with stainless steel fittings. It measures only 24 x 14 x 7 in. and can be universally mounted on a pole or pedestal. The entire unit weighs less than 60 lbs. The equipment is available with a completely transistorized receiver for use in any frequency band including 450 and 960 mc. Complete data from Motorola Inc., Communications and Industrial Electronics Div., 4501 W. Augusta Blvd., Chicago 51, Ill., or circle **No. 9-11** on the reply card.

New Mercury Luminaire Line And Photoelectric Control Announced by General Electric

An all-new line of mercury vapor street and highway luminaires, the Type M, and a new photoelectric control have been announced by General Electric. The new luminaires feature sleek modern appearance, easier installation and maintenance, and higher lighting efficiency. They are available in three basic units: The M-250 (175 or 250-watt), M-400 (400-watt), and M-1000 (700 or 1000-watt). Power Pack built-in ballasts will be standard equipment on the new luminaires although all three units will be available without them. Streets, highways and parking lots are ideal applications for this new type unit.



General Electric mercury luminaires

Two unique features allow extremely flexible use: A multi-position socket that is adjustable in the field to give proper light distributions with clear white and color-improved lamps; and an adjustable clamp in the slipfitter permitting the units to be installed on either 1¼ or 2-inch brackets. A dusk-to-dawn control has an exclusive General Electric sensing element hermetically sealed in a special atmosphere for humidity protection and long life. Simplified circuitry, with fewer operating parts, assures maximum reliability. The control is simply plugged into receptacles on the luminaires and with one twist is locked into working position. More details from General Electric Co., Schenectady 5, N. Y., or circle **No. 9-12** on the reply card.

4-Wheel Drive Terraload'r

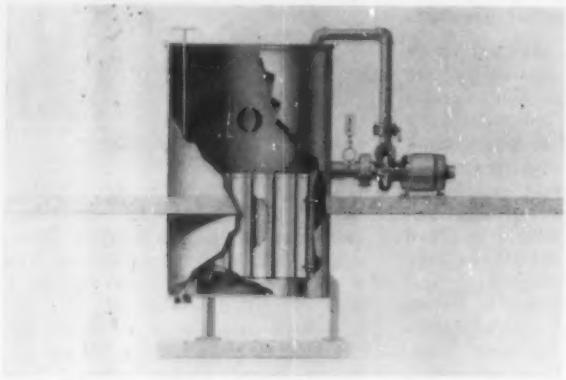
The Model W-10, newest addition to the Case Terraload'r line, has been announced. The 4-wheel drive, rear-wheel steer tractor-shovel has a carry capacity of 6,500 lbs. at 4 mph. Standard bucket size is 2 cu. yds. SAE rated, with a 1¼ cu. yd. heavy-duty bucket, and a 2⅞ cu. yd. light materials bucket optional. Lift capacity at 0 mph is 13,000 lbs. Outstanding feature of the W-10 is its excellent power-to-weight ratio. This is made possible because Case builds not only the machine, but the 100 hp diesel engine as well. The addition of torque converter drive enables the unit to develop tremendous push-power with a minimum of wheel slippage. More data from J. I. Case Co., Racine, Wisc., or circle **No. 9-13** on the reply card.

Grounds Groomer Gathers All Refuse

Wet and dry leaves, grass cuttings, scrap paper and bottles are all picked up without damage to turf or equipment by the Grounds Groomer, a new one-man operated power sweeper made by the Ronning Corp. Designed for use on parks, cemeteries, golf courses and parking lots the unit operates at speeds up to 12 mph depending upon terrain and condition of litter. The power-driven pick-up brush, 5 ft. wide and 14 in. in diameter, has fingers made of durable belting material. The quick-dump body has a capacity of seven cu. yds. Full details from Ronning Corp., 951 Central Ave., Minneapolis 13, Minn., or circle **No. 9-14** on the reply card.

One-man operated sweeper for refuse

Advanced Design Filter



Complete package filter requires very little floor space

An advanced development in vacuum diatomaceous filters has been announced by Neptune. This complete package unit requires little floor space and it requires no skilled labor to operate. It may be placed in the ground or in a building, above, below or at water level, and is easily adapted to an existing installation that is not filtered and to installations that require a more modern system. Available in a wide range of sizes, the largest single unit will filter up to 525,000 gallons of water in an 8-hour turnover at a filter rate of 2 gpm/sq. ft. of filter area. For more information write to the Neptune Filter Co., Inc., 1090 New London Ave., Cranston 10, R. I., or circle **No. 9-16** on the reply card.

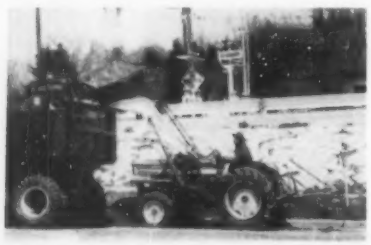
Automatic Roadbuilder

Gurries roadbuilder being used on highway construction

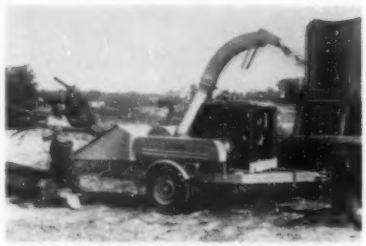
A new idea in roadbuilding equipment is announced by Gurries Mfg. The new Gurries automatic road builder handles virtually every blading job from the scraper to the paver. Called the Garb, the carry-type scraper replaces dozers and trucks on many large volume earth-moving jobs and it can replace many blade machines on spreading, rough grading and finish grading operations. Blade height for both grade and cross-slope are set on large dials by the operator and the unit is accurate to 1/25th-inch in 15 ft. It has a 13-ft. blade, 10-cu. yd. bowl capacity and weighs approximately 28,000 lbs. It has a 20-in. diameter conveyor screw set laterally in the bowl for balancing the load in the bowl in spreading operations or for side casting into a windrow. For additional information write the Gurries Mfg. Co., 1720 South First St., San Jose 12, Calif., or circle **No. 9-18** on the reply card.

New Side-Dump Bucket

International Wagner loaders with side-dump buckets, designed to reduce the cycle time of loading operations by 50 percent, now are available with International 240, 340 and 460 industrial tractors. The new buckets eliminate one complete forward and reverse movement necessary in forward dumping. Maneuvering is cut to a simple forward-reverse action. The operator merely drives the tractor forward into the pile to pick up a load, then reverses directly into position alongside the truck and dumps. Measuring six feet wide, the buckets have a side-dump angle of 60° and front dump angle of 51°. They have a cutting edge of ½ by 6 in. Complete details from Consumer Relations Department, International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 9-15** on the reply card.



Side-dump loader reduces cycle time



Mitts & Merrill brush chipper will handle any length of branches or tree trunks up to eight inches in diameter

Brush Chipper

Mitts & Merrill announces a new, heavy-duty brush chipper. The chipper, will handle with ease, any size or length of branches or tree trunks up to 8 in. in diameter. It features a built-in blower which regulates the direction and delivery of chips. A large, heavy rotating cylinder in between heavy-duty bearings, eliminates the need for an overhanging flywheel and is a special feature for safety and productivity on this type of machine. All-welded construction and special alloy steel plus simple design with the least amount of parts assures practically trouble-free operation and low maintenance costs. Complete data from Mitts & Merrill, Saginaw, Mich., or circle **No. 9-17** on the reply card.

2-Way Mobile Radio

From Aerotron comes a major innovation in VHF-FM 2-way radio. The Aerotron 6N15 is designed for either mobile or base station use. The chassis is no larger in size than a 8½ x 11 page. The unit receives loud and clear and it rejects unwanted off-frequency signals through a filter of original design. It is installed easily and inexpensively and its revolutionary design cuts original costs and requires minimum maintenance time and expense. It is operated on any common power source, 6 or 12 volts DC or 115 volts AC, without modification. For complete information write Aeronautical Electronics, Inc., Raleigh-Durham Airport, Raleigh, N. Car., or circle **No. 9-19** on the reply card.

Hough New Model H-50 Tractor-Shovel

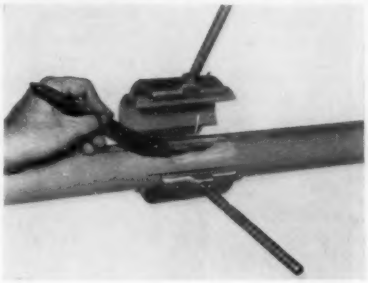
A new four-wheel-drive, rubber-tired tractor shovel with 5,000 lbs. carry capacity, the Model H-50, is announced by Hough. Features of the unit include more power available for both hydraulics and traction, more efficient torque-converter, complete power-shift transmission, power transfer differentials, power-steering, pry-out bucket action, safety boom arms, power-boosted brakes and numerous refinements. The gasoline and diesel engines provide from 90 to 92 hp. The power-shift transmission provides 3 speeds in each direction. Finger-tip shifting up or down in either direction, without foot-clutching or stopping for a range shift, gives fast operating cycles. Complete data from The Frank G. Hough Co., 761 Seventh Ave., Libertyville, Ill., or circle **No. 9-20** on the reply card.

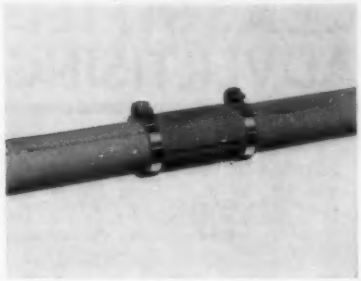
Hydraulic Earth Augers

A re-engineered line of Jaques hydraulic earth augers has been announced. Five different models of the self-contained, completely hydraulic hole diggers can be quickly mounted on standard trucks or jeeps. They can drill holes 9 to 72 in. in diameter and up to 25 ft. deep, in any kind of soil or rock, under proper operation. They operate efficiently from any position up to a 45° angle, from either side of a truck. More data from Texoma Enterprises, Inc., Sherman, Tex., or circle **No. 9-21** on the reply card.

Drilling vertically in rocky soil is no problem with a Jaques earth auger

Pipe Repairs With Solvent-Weld Repair Clamp





On the spot pipe repair can be made quickly by one man

A fast, easy method for "in the field" repairs of PVC plastic pipe is announced by Kraloy. With Kraloy's new "Solvent-Weld Repair Clamp", one man can quickly repair a pipe break, injury or mechanical damage on the spot. Kraloy PVC plastic "half-soles" of special sized stock are supplied in pairs for use in the clamp. Half-soles are applied to damaged area that is thoroughly clean and dry, by the Solvent-Weld, and placed in the repair clamp. Complete details from Kraloy Plastic Pipe Co., Los Angeles, Cali or circle **No. 9-23** on the reply card.

Safety, Efficiency and Multi-Utility in New Racine Hydraulics Compactor

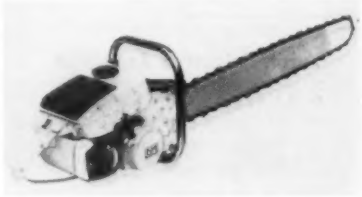
Safety, versatility and easy maintenance are dominant characteristics of the new Rapak, announced by Racine Hydraulics. The self-contained unit requires no auxiliary equipment, with resultant handling ease and safety for the operator, plus greater mobility. One-shot lubrication and simplicity of design hold maintenance to a minimum. The unit is powered by a 4-cycle, 3-hp gas engine and has an adjustable rate of from 400 to 600 blows per minute. It operates in either cohesive or granular soils and will compact cohesives through granular soil to over 100 percent Proctor density. Interchangeable shoes give the compactor a range of working widths from 6 to 18 in. Complete details from Racine Hydraulics & Machinery, Inc., 2000 Albert St., Racine, Wis., or circle **No. 9-22** on the reply card.

Traffic Marking in Plastic

An extruded vinyl strip for traffic marking is available from Auburn Plastics. Used for highway center and border lines, street intersections and crosswalk marking the plastic material is a reflectorized vinyl material that is furnished with an adhesive backing. During installation, additional adhesive is applied to the area to be marked. After the adhesive becomes tacky, the vinyl strip is laid in place and pressed down permanently. The material is easily cut to length and is edge tapered to prevent scuffing. The vinyl material can be produced in many colors; however, black, red, yellow and white will be standard. The self-cleaning material has a pebble finish created by glass beads incorporated in the material, to furnish both a non-skid and a reflecting surface. The strip is available in three widths, 3, 4 and 6 ins. and packaged in 150-ft. rolls. For further information write to Auburn Plastics, Inc., Auburn, N. Y., or circle **No. 9-24** on the reply card.

New Line of Chain Saws

A new line of seven McCulloch chain saws, including a new gear drive model, is announced. The new gear-drive saw, the McCulloch ONE/60, is equipped with either a regular cutter bar or plunge bow. Other models include the MAC 35A, low-priced gear-drive chain saw; the McCulloch ONE/40, direct-drive model; the ONE/50, a more powerful direct-drive saw; the ONE/70, the most powerful direct-drive saw in the line; the ONE/80, most powerful gear-drive one man saw; and the MODEL 99, heavy-duty two man saw. For more details write McCulloch Corp., 6101 West Century Blvd., Los Angeles 45, Calif., or circle **No. 9-25.**



CLASSIFIED ADVERTISING

Mechanical Engineer Wanted

The City of Fort Pierce, Florida is accepting applications for the position of Mechanical Engineer in the municipally owned Steam Generating Power Plant. Applicant must have a valid degree in mechanical engineering. Interview arranged on basis of letter stating qualifications, educational background, previous employment, and compensation received. Salary range for this position $7,200 to $10,000 per year.

Reply to:

Mr. Edward C. Peterson
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ENGINEERS WANTED

The City of Hazel Park, Michigan is seeking a City Engineer and an Assistant Engineer. Tentative salaries of approximately $9,000 and $7,500 per year. Hazel Park is a community of approximately 27,000 and has problems in urban renewal, street development and drainage.

Reply to:

Mr. Leonard L. Bishop, Jr.
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Mr. Robert W. Duncan
Village Manager
Shorewood, Wisconsin

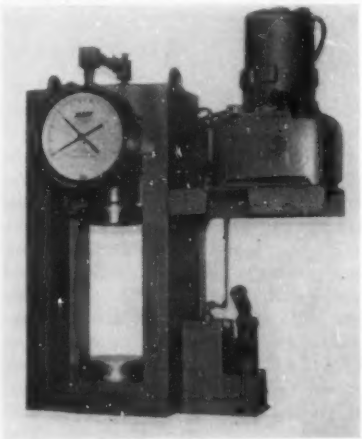
Pax-It bodies are available mounted or unmounted and in 16 or 20-yard capacities

Sanitary Refuse Compactor Unit

A new sanitary refuse compactor unit is announced by Pax-It Equipment Co. Available in 16 and 20-yd. models, mounted or unmounted, the Pax-It unit features corrosion and rust-resistant alloy steel body, doors and packing blade rear doors and completely enclosed mechanism. Doors, steps and carry-cans are recessed, neatly flush with the contour of the sides. The exclusive Pax-It tank is shell-shaped to reduce over-all height and provide a lower center of gravity. Fall-back packed refuse is also reduced by this unique design. The lower, smaller and lighter-weight unit makes confined alleys and low clearance areas easily accessible. The patented plow type blade that projects into the bottom channel to get under the load and push it upward and to the sides for maximum use of tank space is the heart of the unit. The compactor itself can be operated from either the cab or the ground by means of control levers or optional push-button controls on both sides of the unit. More data from Pax-It Equipment Co., Inc., 814 Second Ave. Bldg., Seattle 1, Wash., or circle **No. 9-26** on the reply card.

Electrically Operated Jobsite Concrete Tester

The new Forney Model FT-20-E is said to open up a new era in jobsite concrete testing because the special constant flow electric pump is permanently mounted so that the former method of attaching an electric pump by means of a length of hose is completely eliminated. Weighing only 540 lbs. equipped with both manual and electric pumps, the tester can still be easily moved from one jobsite to another, and with a maximum load rating of 250,000 lbs., it is more than capable of handling the most exacting type of inspection. More details from Forney's Inc., Tester Div., P. O. Box 310, New Castle, Pa., or circle **No. 9-27** on the reply card.



Forney tester weighs only 50 pounds

Kelley Hot-Shot Space Heater

Designed for use on construction jobs where portability and fast heating are essential, the new, small size Hot-Shot 75,000/Btu/hr space heater has been developed by the Kelley Machine Division. It is one in a full range of sizes offered by Kelley: Model 75KHA 75,000 Btu/hr; Model 125 KHA 125,000 Btu/hr; Model 300 KHA, 300,000 Btu/hr; and Model 450 KHA 450,000 Btu/hr. The Hot-Shot 75, like the other Kelley models, can be used to heat buildings during construction, and to warm workmen and work areas indoors or outdoors. It dries, warms and thaws building materials; also thaws pumps and piping, as well as preheats construction machinery and equipment. More data from Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Hinman Ave., Buffalo 23, N. Y., or circle **No. 9-28** on the reply card.

NEWS OF ENGINEERS

DAVE BENHAM of the consulting engineering firm of Benham Engrg. Co., Oklahoma City and Muskogee, Okla., has been appointed to the Oklahoma Board of Engineering Registration, succeeding EDWARD R. STAPLEY, well-known dean emeritus of the Oklahoma University College of Engineering.

COL. HARRY O. FISCHER is now Division Engineer, North Central Division, Corps of Engineers, Chicago, Ill. He will supervise the work of the Engineer Districts at Chicago, St. Paul, Rock Island, Detroit and Buffalo and the U. S. Lake Survey at Detroit.

ROY B. EVERSON, President of the Everson Mfg. Co., Chicago, a typical "small business" man for nearly 60 years, celebrated his 80th birthday on July 12. He has installed five thousand sterelators in the U. S., Canada and Mexico and as far distant as Okinawa. He has been a leader in swimming pool design. He engineered a "super-Olympian" pool for his friend Henry Ford 25 years ago; he pioneered with safe underwater pool lights; and he introduced the European invention of underwater observation windows for swimming pools. During the years he has patented or copyrighted nearly 150 devices. We congratulate him heartily.

Mr. Everson

PROF. HAROLD E. BABBITT will act as Visiting Professor of Sanitary Engineering at the Iowa State University in the absence of DR. E. ROBERT BAUMAN, who will spend the 1959-60 collegiate year at the University of Durham, England.

• • •

Engineer With Writing Ability Wanted

Excellent opportunity in the editorial field for an engineer with considerable experience in highway engineering. Must be a graduate engineer. Location in the East. Good living conditions; pleasant working conditions, benefits and good salary to right man. Write Box H-9, c/o Public Works, 200 South Broad St., Ridgewood, N. J.

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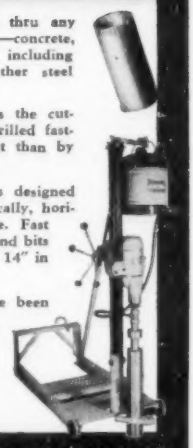

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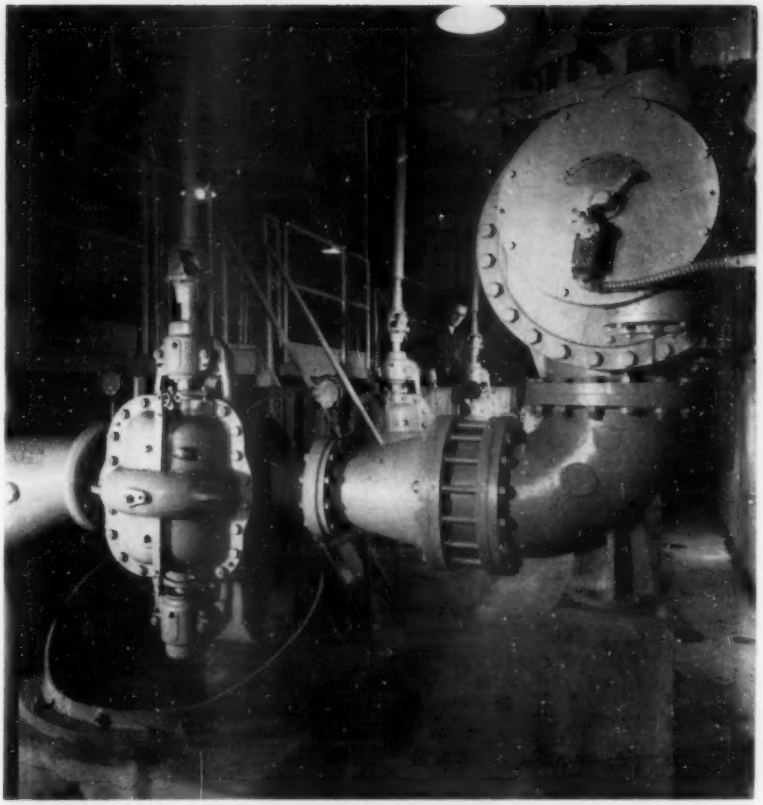
Pumping Station Anticipates Future Needs

A NEW supplementary pumping station designed to handle estimated water requirements for the next 25 years was completed recently by the City of West Allis, Wisconsin. Water for the community is supplied by the City of Milwaukee and is stored in a 4 million gallon reservoir in which the water level is maintained at 17 feet by a 30-inch butterfly valve at the intake.

A number of pieces of Allis-Chalmers equipment are installed at the pumping station, which is of the dry pit type for ease of maintenance. These include three vertically mounted 12 by 10-in. dry pit pumps; two 250-hp and one 200-hp, 1750-rpm induction motors for pump drive mounted above flood level; 14 rubber-seated butterfly valves ranging from 16 to 30 ins. in diameter; three 14-in. Roto-Valve units; an oil accumulator system with a 200-gallon tank, starters, and transformer.



● ONE OF THE pumps at the West Allis, Wis., pumping station. A Roto-Valve is located on each pump discharge. 14 rubber-seated butterfly valves are used also.

Rubber Cushions Path for Motorists

ONE OF THE country's first rubber railroad crossings has been installed over a double set of curved tracks at Wooster, Ohio. Developed by the Goodyear Tire and Rubber Co., rubber railroad crossings are in use at a number of places in the U. S., but this is the first time rubber pads have been tried on a curve. To provide a completely smooth surface, rubber plugs are placed in the bolt holes after the pads have been bolted to the ties. Ice will not hold on the pads and motorist-irritating bumps are completely eliminated. The rubber crossing installation is said to last about 20 years.

Water Services Maintained by Payloader

THE Portland, Maine, Water District services a 20-mile square area and supplies some 150,000 people. General maintenance of services, and operations involving less than 100 lineal feet of excavation are handled by a Model HU "Payloader" tractor-shovel equipped with a Wain-Roy backhoe. Shown is the Hough unit excavating a trench for installation of a new lateral. After the pipe is installed, a Wain-Roy backfill blade will replace the hoe attachment to complete the job. In this type of work, mobility of the "Payloader" tractor-shovel is the biggest advantage. The change-over of attachments is fast and very easy, according to Superintendent J. P. Hennings.

● EXCAVATING trench for the replacement of an old lateral with larger pipe.

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Compact, portable Taylor Comparators let you make on-the-spot pH or chlorine tests in minutes. No experience necessary. Just fill center tube with treated sample and move color slide across until sample matches one of the standards. Values are then read directly from the slide.

Be sure to use only Taylor reagents and accessories with Taylor Comparators to assure accurate results. Sealed-in-plastic color standards are guaranteed against fading.

SEE YOUR DEALER for Taylor sets or immediate replacement of supplies. Write direct for FREE HANDBOOK, "Modern pH and Chlorine Control". Gives theory and application of pH control. Illustrates and describes full line.

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7304 YORK RD. • BALTIMORE 4, MD

★ After 16 years at 612 North Michigan Ave., PUBLIC WORKS Publications have moved their Chicago advertising office to larger quarters at 333 North Michigan. **Robert J. Shea** remains in charge.

★ An attractively illustrated booklet just received tells of the voyage of the "Mollihawk 1958" to Tobago in the Caribbean with **J. Don Walker** of Walker Process Equipment, Inc., Aurora, Ill., as navigator.

★ American Pipe & Construction Co. of Monterey Park, Calif., and Nukem Products Corporation of Buffalo, N. Y., have merged, to provide increased facilities on two coasts in the field of corrosion-resistant products.

★ **J. E. Chadwick** heads a new department of Koehring Company, Milwaukee, to integrate sales to national and fleet buyers of Koehring products.

★ **Everett Smith** is named executive vice-pres. Standard Chlorine Chemical Co., of which The Cloroben Chemical Corporation at South Kearny, N. J. is a subsidiary.

Mr. Smith

Mr. Craig

★ **Joseph E. Craig** will function in advertising and sales promotion, the Warner & Swasey Company's Gradall and Hopto lines of earth-moving and construction equipment.

★ **R. G. Herbst** has been appointed general sales manager, "Quick-Way" Truck Shovel Co., Denver, succeeding **T. S. Petersen,** resigned.

★ **John W. Sullivan** becomes Remington-Rand UNIVAC Division's Western Area representative for City, County and State government offices interested in use of Data Processing equipment, with headquarters at 2601 Wilshire Blvd., Los Angeles.

Mr. Rosenblatt

★ President **Jos. Rosenblatt** of the Eimco Corporation, Salt Lake City, elected an industrial director of the Federal Reserve Bank of San Francisco. This is regarded as significant recognition of the growing importance of the Intermountain West to the 12th Federal Reserve District.

★ **Don J. Douglas** is promoted to general sales manager, Reflective Products Division, Minnesota Mining and Manufacturing Co., St. Paul.

★ **William Feick, Jr.** becomes vice president-sales, Flinkote Division of The Flintkote Company, New York.

★ Smith & Loveless Inc., Lanexa, Kansas, Mfrs. of sewage lifts and treatment plants, appoint **Frank G. Weis** chief research engineer, **Charles R. Faes** chief production engineer, and **Cecil Waage,** chief draftsman.

★ **Charles Yeomans,** 81, co-founder and Board chairman of Yeomans Brothers Co., in suburban Chicago, died July 28. The firm is known worldwide in the pump and sewage treatment field.

★ Waukesha Motor Co. (Wisconsin) announces three new branches in Southern California. Products are Waukesha, Climax Roiline (formerly Le Roi) engines.

★ **Burt Bathke** is appointed sales manager, Kelley Machine Division, The Wiesner-Rapp Corporation, Buffalo, power equipment for highway work.

Robert L. Logan is now western zone manager for Daybrook Hydraulic Division, of Bowling Green, Ohio, refuse compaction equipment, with headquarters in Alamo, San Francisco.

★ First mountaineer: "I hear them foreigners down in Cumberland Gap is making ice in August. Second same: "You know that's a lie: God hisself can't make ice in August."

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Horton® all-welded structures meet the increasing water storage requirements of growing communities by—

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- Increasing water pressure
- Providing emergency reserves
- Reducing pumping costs

STANDPIPE

RADIAL-CONE TANK
500,000 to 3,000,000 gals.

WATERSPHERE®
25,000 to 250,000 gals.

WATERSPHEROID®
300,000 to 500,000 gals.

HORTONSPHEROIDAL TANK
1,000,000 to 3,000,000 gals.

ELLIPSOIDAL-BOTTOM TANK
15,000 to 500,000 gals.

RESERVOIR

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

A specific answer to any municipal water storage or pressure distribution problem can be found in the range of capacity and style of structure offered by CB&I in Horton steel tanks. All are built in accordance with AWWA specifications. Write our nearest office for further details.

M42

the V-notch

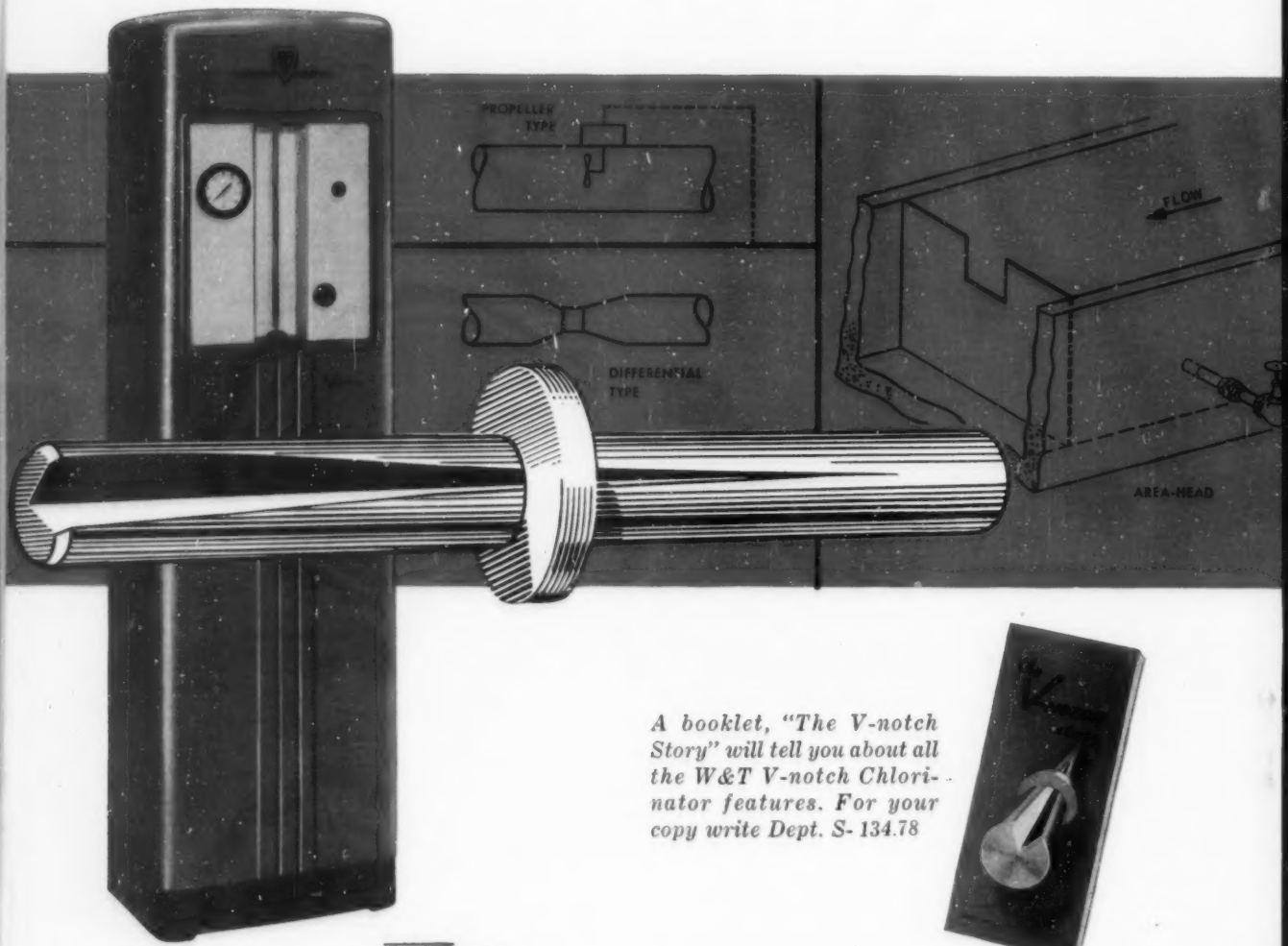
ready and waiting for your signal

Lots of jobs are done better automatically. Changing chlorine feed rate is now one of them. With the V-notch... the straight line metering action of the plug through the ring makes automation simple.

Merely by adding, not adapting, a W&T V-notch Chlorinator can give you any degree of automatic control you want—step rate, start-stop, program, proportional, even residual control.

With a V-notch Chlorinator any signal from any primary metering device can control chlorine feed. So anyone can afford automation.

And, of course, the right plastics make the whole chlorinator chlorine-proof.



A booklet, "The V-notch Story" will tell you about all the W&T V-notch Chlorinator features. For your copy write Dept. S-134.78

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY